# *Liebert® eXL™ Uninterruptible Power System*

*Operation and Maintenance Manual—625-1200kVA, 60Hz, Three-Phase, Single & Multi-Module*

EMERSON
Network Power

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## IMPORTANT SAFETY INSTRUCTIONS

# SAVE THESE INSTRUCTIONS

This manual contains important instructions that should be followed during installation and maintenance of the Liebert *e*XL uninterruptible power system and DC source.

## WARNING

Risk of electric shock. Can cause equipment damage, injury or death.

Exercise extreme care when handling UPS cabinets to avoid equipment damage or injury to personnel. Refer to separate installation manual for equipment handling information and installation procedures.

Follow all DC source safety precautions in **5.0 - Maintenance** when installing, charging or servicing DC sources. In addition to the hazard of electric shock, gas produced by batteries can be explosive and sulfuric acid can cause severe burns.

In case of fire involving electrical equipment, use only carbon dioxide fire extinguishers or others approved for use in electrical fire fighting.

Extreme caution is required when performing maintenance. Service and maintenance work must be performed only by properly trained and qualified personnel and in accordance with applicable regulations as well as with manufacturers' specifications.

Be constantly aware that the UPS contains high DC as well as AC voltages. With input power off and the DC source disconnected, high voltage at filter capacitors and power circuits should be discharged within 5 minutes. However, if a power circuit failure has occurred, assume that high voltage still exists after shutdown. Check with a voltmeter before making contact.

AC voltage will remain on the system bypass, the UPS output terminals and the static bypass switch, unless associated external circuit breakers are opened.

Check for voltage with both AC and DC voltmeters prior to making contact.

When the UPS is under power, both the operator and any test equipment must be isolated from direct contact with earth ground and the UPS chassis frame by using rubber mats.

Some components within the cabinets are not connected to the chassis ground. Any contact between floating circuits and the chassis is a lethal shock hazard. Exercise caution that the test instrument exterior does not make contact, either physically or electrically, with earth ground.

# AVERTISSEMENT

Risque de décharge électrique pouvant entraîner des dommages matériels, des blessures et même la mort.

Faites preuve d'une extrême prudence lors de la manutention des armoires ASC afin d'éviter de les endommager ou de blesser le personnel. Reportez-vous au manuel d'installation approprié pour connaître les consignes de manutention et les procédures d'installation de l'équipement. Observez toutes les mesures de sécurité relatives à la source d'alimentation c.c. décrites dans la section **4.0 - Entretien lors de l'installation**, de la charge ou de l'entretien des sources c.c. Outre les risques de décharge électrique associés aux batteries, les gaz qu'elles produisent peuvent être explosifs et l'acide sulfurique qu'elles contiennent peut provoquer des brûlures graves.

En cas d'incendie associé à du matériel électrique, n'utilisez que des extincteurs à dioxyde de carbone ou homologués pour la lutte contre les incendies d'origine électrique.

Les opérations d'entretien requièrent une extrême prudence. Les opérations d'entretien ne doivent être confiées qu'à du personnel qualifié et dûment formé. Toutes les interventions doivent être effectuées conformément aux règlements applicables et aux spécifications du fabricant. Soyez toujours conscient du fait que le système ASC contient des tensions c.c. et c.a. élevées.

Une fois l'alimentation d'entrée coupée et la source d'alimentation c.c. débranchée, la haute tension aux condensateurs de filtrage et aux circuits d'alimentation devrait se dissiper en moins de 5 minutes. En cas de défaillance d'un circuit d'alimentation, toutefois, il importe de présumer qu'une tension élevée est présente même après l'arrêt. Vérifiez toujours les tensions avec un voltmètre avant d'établir des contacts.

Le circuit de dérivation, les bornes de sortie ASC et le commutateur statique de derivation continueront d'afficher une tension c.a. à moins que les disjoncteurs externes associés ne soient ouverts.

Vérifiez les tensions avec des voltmètres c.a. et c.c. avant d'établir tout contact.

Lorsque le système ASC est sous tension, les responsables de l'entretien et l'équipement d'essai doivent reposer sur des tapis de caoutchouc pour prévenir tout contact direct avec le sol et avec le châssis du système lors des interventions.

Certains composants à l'intérieur des armoires ne sont pas connectés à la masse du châssis. Tout contact entre les circuits flottants et le châssis présente un risque de décharge mortelle. Il importe de veiller à ce que l'extérieur des équipements d'essai n'entre pas en contact physique ou électrique avec le sol.

**This equipment contains circuitry that is energized with high voltage.** Only test equipment designated for troubleshooting should be used. This is particularly true for oscilloscopes. Always check with an AC and DC voltmeter to ensure safety before making contact or using tools. Even when the power is turned Off, dangerously high voltage may exist at the capacitor banks.

Observe all DC source precautions when near the DC source for any reason.

**ONLY properly trained and qualified service personnel should perform maintenance on the UPS system.** When performing maintenance on any part of the equipment under power, service personnel and test equipment should be standing on rubber mats. The service personnel should wear insulating shoes for isolation from direct contact with the floor (earth ground).

One person should never work alone. A second person should be standing by to assist and summon help in case an accident should occur. This is particularly true when work is performed on the DC source.

## BATTERY CABINET PRECAUTIONS

The following warning applies to all battery cabinets supplied with UPS systems. Additional warnings and cautions applicable to battery cabinets may be found in **Important Safety Instructions on page 1** and **5.3 - Battery Maintenance**.

# WARNING

Internal battery strapping must be verified by manufacturer prior to moving a battery cabinet (after initial installation).

- Battery cabinets contain non-spillable batteries.
- Keep units upright.
- Do not stack.
- Do not tilt.

Failure to heed this warning could result in smoke, fire or electric hazard.

Call 1-800-LIEBERT before moving battery cabinets (after initial installation).

For systems using DC sources other than batteries, refer to the manufacturers's recommendations for handling and care.

# AVERTISSEMENT

L'arrimage des batteries internes doit être vérifié par le fabricant avant de déplacer une armoire de batteries (après l'installation initiale).

- Les armoires de batteries contiennent des batteries étanches.
- Maintenir les systèmes à la verticale.
- Ne pas empiler.
- Ne pas incliner.
- Le non-respect de ces consignes comporte des risques liés à la fumée, au feu ou à l'électricité.
- Composez le 1 800 LIEBERT avant de déplacer des armoires de batteries (après l'installation initiale).

Reportez-vous aux recommandations du fabricant relatives à la manipulation et à l'entretien pour les systèmes qui utilisent d'autres sources d'alimentation c.c. que les batteries

### Contacting Emerson Network Power® for Support

Contact Emerson Network Power Liebert® Services for information or repair service in the United States at 1-800-LIEBERT (1-800-543-2378).

For repair or maintenance service outside the 48 contiguous United States, contact Liebert Services, if available in your area. For areas not covered by Liebert Services, the authorized distributor is responsible for providing qualified, factory-authorized service.

Have the following information available before calling Liebert Services:

Part Numbers: _____

Serial Numbers: _____

kVA Rating: _____

Date Purchased: _____

Date Installed: _____

Location: _____

Input Voltage/Frequency: _____

Output Voltage/Frequency: _____

DC Source Reserve Time: _____

# 1.0 INTRODUCTION

## 1.1 General Description

The Liebert *e*XL provides continuous, high-quality AC power to business-critical equipment, such as telecommunications and data processing equipment. The Liebert *e*XL supplies power that is free of the disturbances and variations in voltage and frequency common to utility power, which is subject to brownouts, blackouts, surges and sags.

The Liebert *e*XL utilizes the latest in high-frequency, double-conversion pulse-width modulation technology and fully digital controls to enhance its reliability and increase the ease of use.

As shown in **Figure 1**, the AC utility source is input at the rectifier and the rectifier converts the AC utility into DC power. The inverter converts that DC power from the rectifier or DC power from the DC source- into AC power for the load. The DC source will power the load through the inverter in the event of a power failure. The utility source can also power the load through the static bypass.

If maintenance or repair of the UPS is necessary, the load can be switched without interruption in service to the optional maintenance bypass.

**Figure 1 Typical single module UPS one-line diagram**

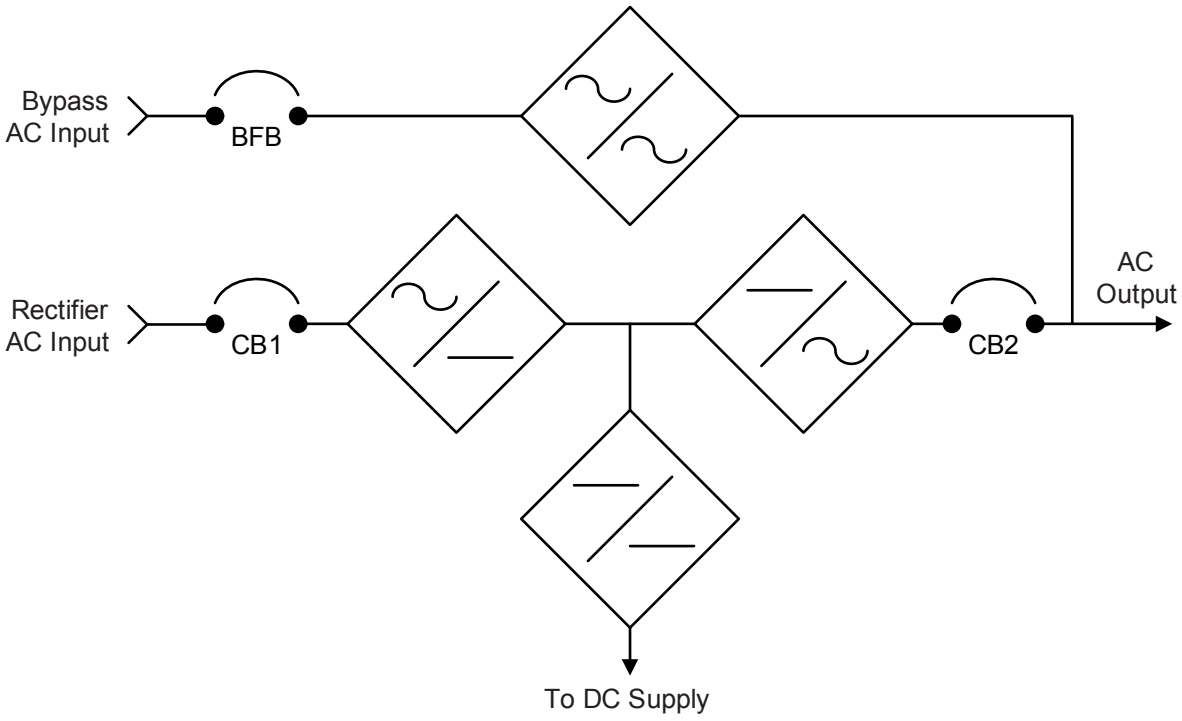
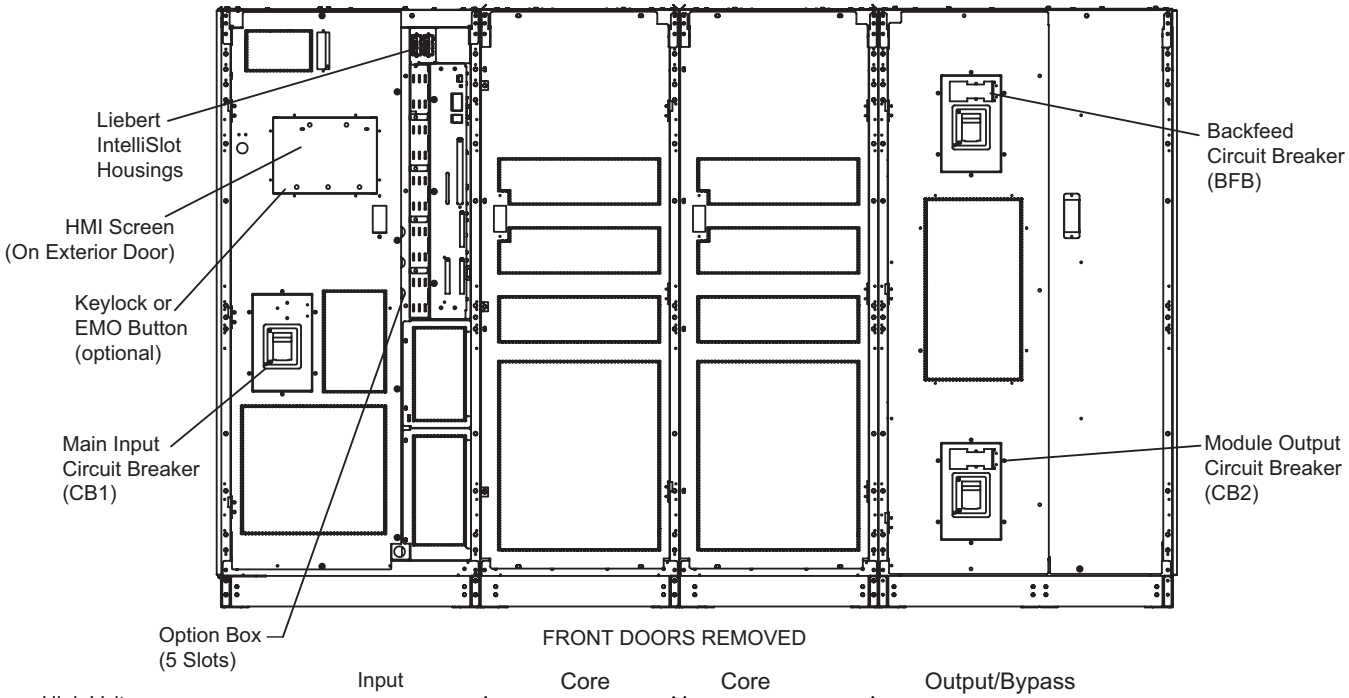


**Figure 2 Main component locations—625kVA, 750kVA and 800kVA (typical)**


Liebert IntelliSlot Housings
HMI Screen (On Exterior Door)
Keylock or EMO Button (optional)
Main Input Circuit Breaker (CB1)
Option Box (5 Slots)
Backfeed Circuit Breaker (BFB)
Module Output Circuit Breaker (CB2)
FRONT DOORS REMOVED

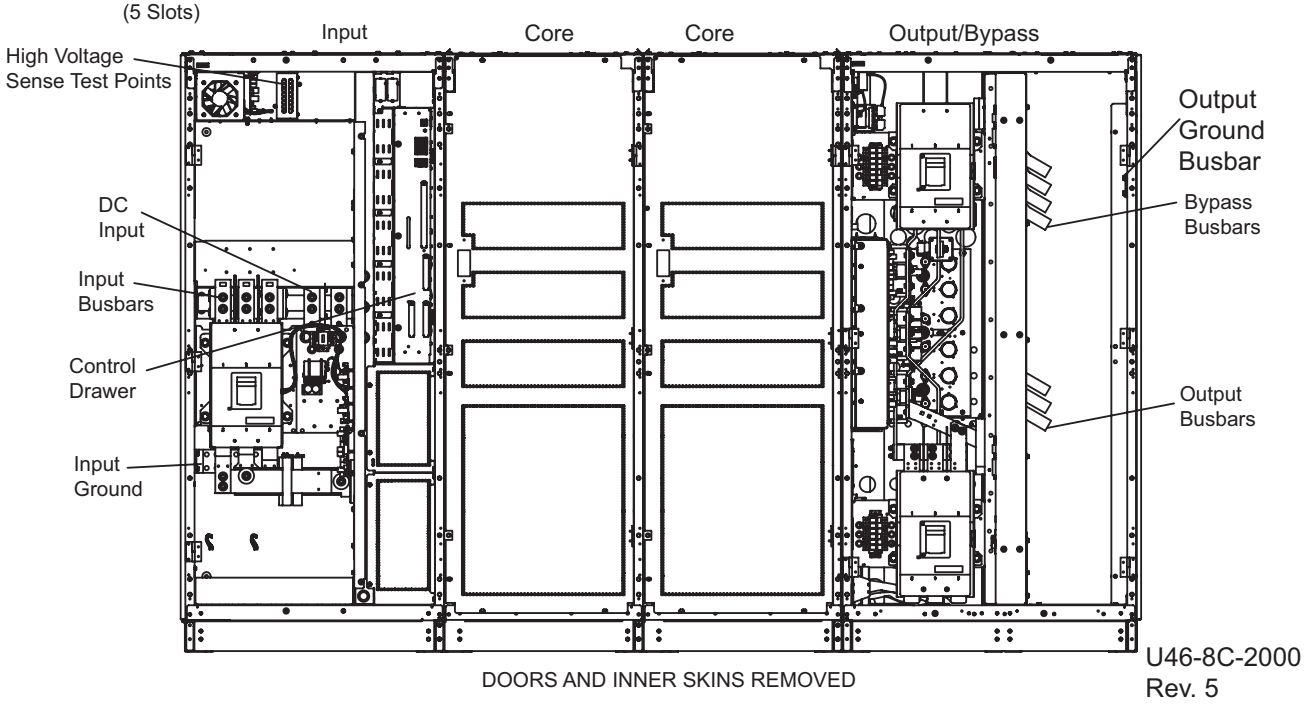



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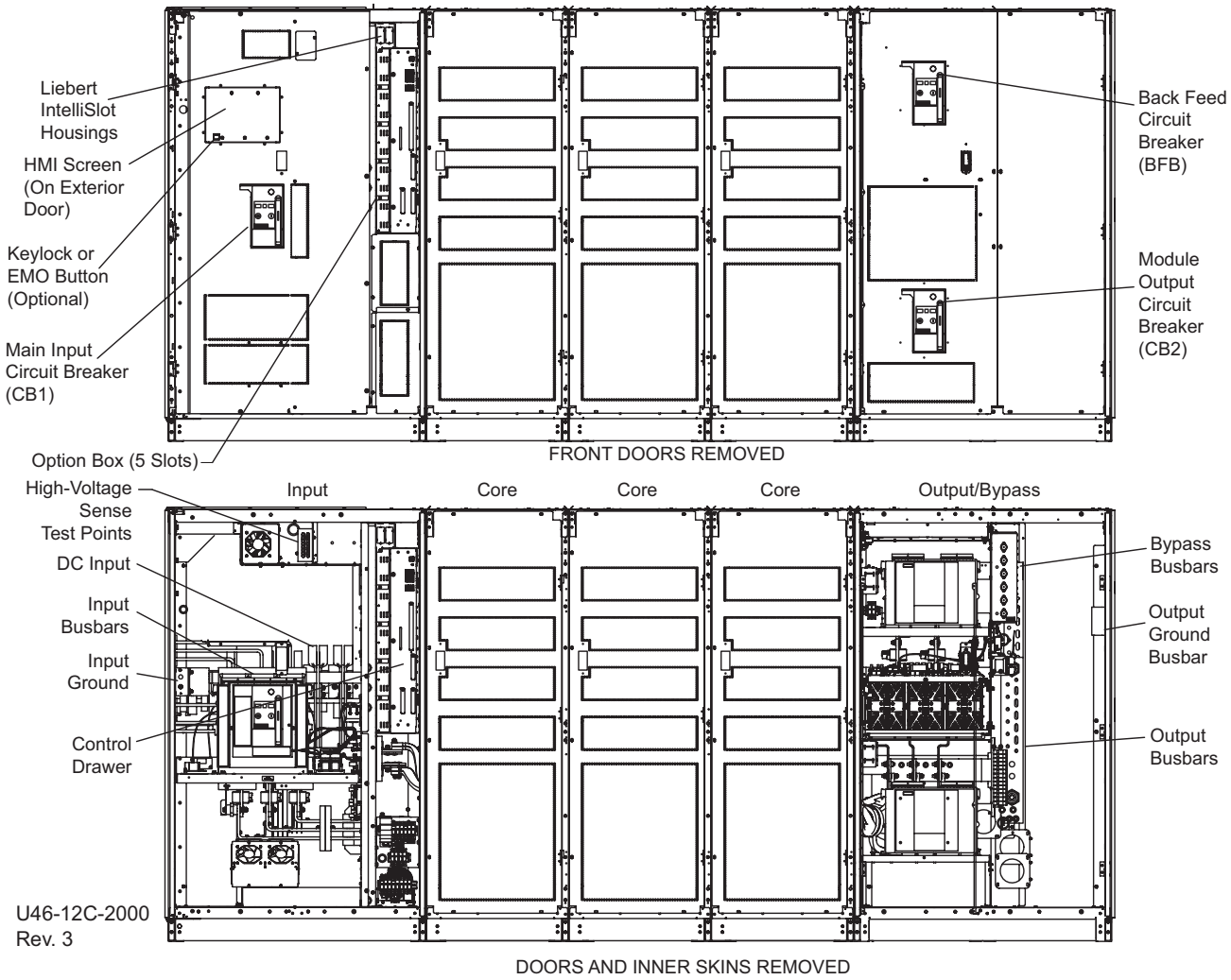
**Figure 3 Main component locations--1000kVA, 1100kVA, and 1200kVA (typical)**




## 1.2 Modes of Operation

### 1.2.1 Normal Mode

Operating in normal mode, the Liebert *e*XL's rectifier derives power from a utility AC source and supplies regulated DC power to the inverter, which regenerates precise AC power to supply the connected equipment. The rectifier also uses the utility source power to charge the DC sources.

### 1.2.2 Bypass Mode

When the Liebert *e*XL is in bypass mode, the load is directly supported by utility power and is without DC source backup protection.

The Liebert *e*XL's inverter and bypass static switch will shift the load from the inverter to bypass mode without an interruption in AC power if the inverter is synchronous with the bypass and any of the following occurs:

- Inverter fails
- Inverter overload capacity is exceeded
- Inverter is manually turned off by the user

**NOTE**

*If the inverter is asynchronous with the bypass, the static switch will transfer the load from the inverter to the bypass WITH interruption in AC power to the critical load. This interruption is 167ms when the Bypass-Interrupted Transfer is set to* Normal. *The interruption is 33ms when the Bypass-Interrupted Transfer is set to* Fast. *The default setting for interrupted transfer is* Fast*, but Liebert Services can adjust the interrupted transfer to* Slow.

### 1.2.3 Battery Mode

When utility AC power fails, the Liebert *e*XL protects the critical load by instantaneously channeling DC source power to the inverter, which continues supporting the critical load without interruption.

When utility power returns and is within acceptable limits, the Liebert *e*XL automatically shifts back to Normal mode, with the rectifier powering the critical load.

### 1.2.4 Maintenance Bypass

The installation of a Maintenance Bypass Cabinet or Assembly is recommended to allow total isolation of the UPS from all power sources while continuing to supply power to the critical load. Maintenance Bypass use is described in **3.0 - Operations**.

## 1.3 Options

A number of options are available from Emerson® for the Liebert *e*XL. (Some options are not available for all ratings.) Described below are the most frequently provided options. Other options are available. Contact your Emerson representative for more information.

- **Battery and Racks**—The batteries provide power in the event of a power outage. The Liebert *e*XL can use a variety of battery types, provided the battery plant is designed for the UPS DC voltage range and the load requirements of the application.
- **Battery Cabinets**—Valve-regulated, lead-acid (VRLA) sealed batteries are available in matching cabinets for convenient installation and maintenance in otherwise unprotected space. Depending on the UPS module rating, two or more cabinets may be connected in parallel to provide the additional run time. This option is required to complete the UPS system.
- **Module Battery Disconnect**—The UPS system utilizes a separate Module Battery Disconnect for remotely located batteries. A sensing circuit in the UPS module, set at the battery low voltage limit, trips the Module Battery Disconnect to safeguard the battery from excessive discharge. The Module Battery Disconnect has an undervoltage release mechanism designed to ensure that during any shutdown or failure mode all battery potential is removed from the UPS system.
- **Maintenance Bypass**—This switchboard provides make-before-break maintenance bypass. It includes: Maintenance Bypass Breaker (MBB) and Maintenance Isolation Breaker (MIB).
- **Customer Alarm Interface**—This optional interface board allows the input and display of eight alarms from customer-supplied contacts, each with a customer-selected name.
- **External Control**—The optional Programmable Relay Board allows the UPS to trigger external devices when a UPS event occurs. For example, the UPS can turn On an external LED if it senses a battery cabinet temperature imbalance.

# 2.0 LCD TOUCHSCREEN

The Liebert *e*XL is equipped with a microprocessor-based human-machine interface (HMI) designed for convenient and reliable operation. The display is driven by an easy-to- follow, menu-prompted software.

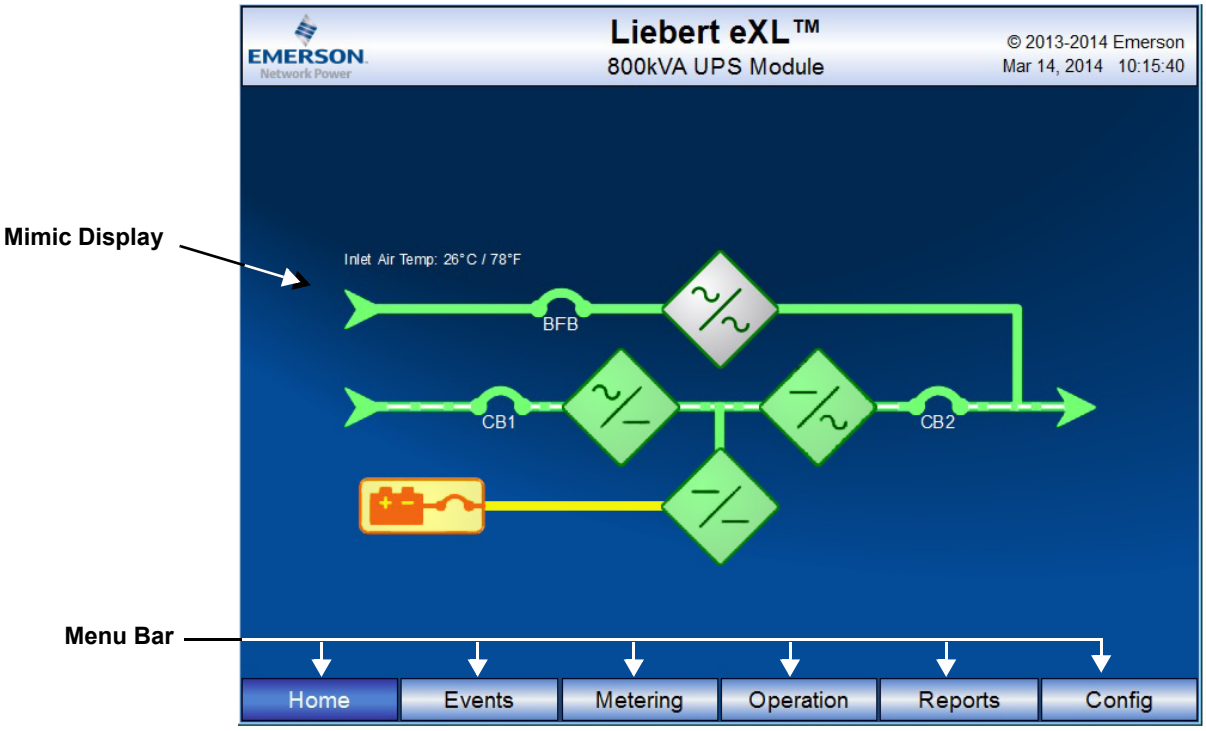
## 2.1 Features

The Liebert *e*XL HMI enables the operator to perform such tasks as:

- Quickly check operational status
- Monitor the power flow through the UPS system and all meter readings
- Execute operational procedures
- Check status reports and history files
- Adjust programmable parameters (access limited by security access function)

The HMI is a touchscreen display with multicolor text and white background (see **Figure 4**). The display turns on automatically, but after 15 minutes of inactivity the backlight will go out and the display will appear very dim. Touching the screen will reactivate the backlight; the backlight will again be active for 15 minutes. If any screen other than the mimic screen is accessed, that screen will be displayed for 5 minutes without any interaction. If there is no activity for 5 minutes, the display will revert to the basic mimic screen.

**Figure 4 Main display screen, typical**




**Bypass Input**—The bypass circuit breaker (BFB) status is shown as Open or Closed.

**UPS Input Power**—The input circuit breaker (CB1) (if installed), is shown as Open or Closed.

**UPS Output Power**—The output circuit breaker (CB2) (if installed), is shown as Open or Closed.

**Rectifier Block**—Displays the state of the rectifier: On (solid green); Disabled (gray); Off (green outline, gray interior); or Walking In (green outline, flashing green interior).

**Inverter Block**—Displays the state of the inverter: On (solid green); Disabled (gray); Off (green outline, gray interior).

**Bypass Static Switch Block**—Displays the state of the bypass static switch: On (solid green), disabled (gray), Off (green outline, gray interior).

**DC/DC Converter Block**—Displays the state of the DC/DC converter: On (solid green); Disabled (gray); Off (green outline, gray interior); or Walking In (green outline, flashing green interior).

**Battery Block**—Displays the state of the battery block and module battery disconnect: Normal (solid green); Fail or High (gray); Low (yellow); and the module battery disconnect is shown as open or closed.

## 2.2 Touchscreen Navigation

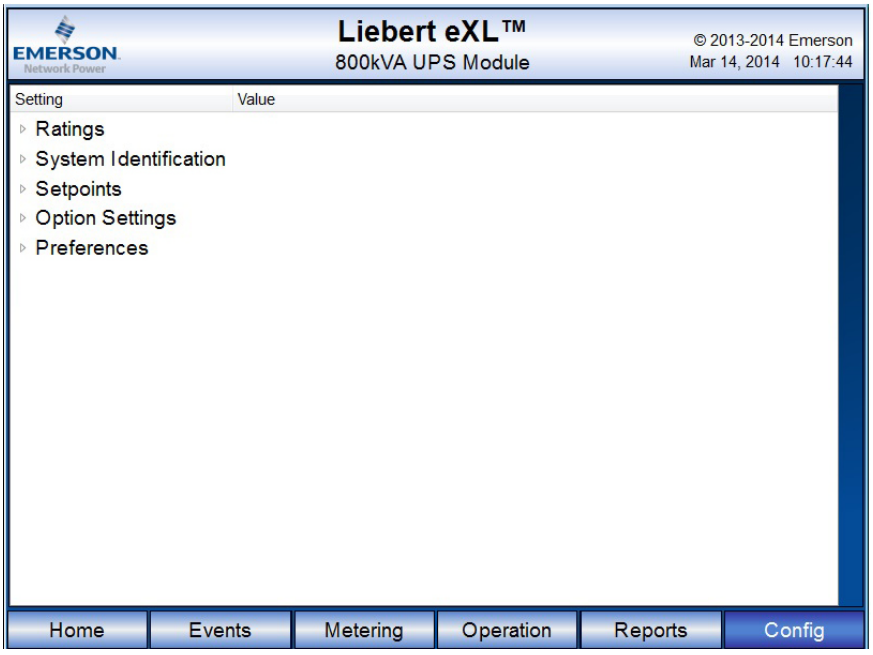
### 2.2.1 Main Display Screen (Home)

Several menu items can be accessed from the main display screen (see **Figure 4**). These menu items are detailed in subsequent sections.

### 2.2.2 Configuration Menu Rating (Config)

This menu item will display a popup showing the following parameters. These parameters are entered during commissioning when the UPS is installed by Emerson Network Power® Liebert® Services™.

**Figure 5 Configuration menu**




#### Ratings

This menu shows the basic information of the module. These parameters will set automatically based on the other parameters entered.

- Nominal Input Voltage
- Nominal Bypass Voltage
- Nominal Output Voltage
- Nominal Source Frequency
- Nominal Output Frequency
- Output kVA
- Output kW
- Configuration Type
- Nominal Cell Count

### System Identification

This menu shows the model numbers and serial numbers:

- Unit Model Number
- Unit Serial Number
- Maintenance Bypass Model Number
- Maintenance Bypass Serial Number
- DC Source Cabinet Model Number
- DC Cabinet Serial Numbers
- Order Numbers
- Service Telephone Number
- Site ID Number
- Module Locator
  - Location ID
  - System Number
  - Module Label

### Setpoints (User Adjustable)

The following will change the settings of the modules:

- **Temperatures**
  Inlet Air Temp Warning—86°F to 104°F (30°C to 40°C) (default: 95°F [35°C])
- **Bypass/Transfer**
  - Manual Xfer to Bypass Voltage High Limit% - 1% to 15% (default: 10%)
  - Manual Xfer to Bypass Voltage Low Limit% - 1% to 20% (default: 10%)
- **Output**
  Max Load Exceeded
  The module will activate a warning when the load is above any of these settings:
  - Phase A (%)—10% to 105% (default: 100%)
  - Phase B (%)—10% to 105% (default: 100%)
  - Phase C (%)—10% to 105% (default: 100%)
  - Delay (seconds)—0 to 60 (default: 5 seconds)
- **Event Management**
  This menu item permits changing how the Liebert *e*XL handles Alarms, Faults and Status information. Each event can be configured for the following:
  - Latch (yes/no)—Event stays active in the event window, even if cleared, until acknowledged (by pressing "Reset" button)
  - Audible (yes/no)—Will set Audible alarm when event occurs
  - Event log (yes/no)—Will display event in Event log when it occurs
- **DC Source**
  Float Voltage
  - Battery Float Voltage, VPC: 2.15 to 2.3 (default: 2.25)
- **Cell Count Adjustment**
  - Cell Count Adjustment: -12 cells to 6 cells (default: 0)
- **Discharge Alarms**
  - Time Low Warning, minutes: 2 to 15, the upper limit is dependent on configured batteries (default: 5 minutes)
- **DC Source Charging**: Settings not user-adjustable

- **DC Source Equalize**
  When Battery Equalize is activated, the module will charge the batteries to the Equalize Voltage for the length of Equalized Time.
  - Equalize Voltage, VPC—2.30 to 2.45 (default: 2.3)
  - Equalize Time, hours—0 to 200 hours (default: 0)
- **DC Source Temperature**

**NOTE**
*DC Source Temperature values should be set by Liebert Services according to the battery manufacturer's requirements.*

  - Battery Temp Warning—30°C to 50°C (default: 40°C)
  - Battery Temp Limit—35°C to 60°C (default: 50°C)
  - Disconnect—Enable/Disable (default: disabled)

**NOTE**
*If Disconnect is set to Enable and the Battery Temp Limit is met, the Battery breaker will open.*

### Factory/Witness

- Touch Screen Calibration

### Options Settings

If any Input Contact Isolator (ICI) cards or Programmable Relay Board (PRB) cards are installed, this menu will allow these options to be configured. See **4.1 - Input Contact Isolator Board** and **4.2 - Programmable Relay Board** for details on these options.

### Preferences

These display settings can be changed from the touchscreen. Press the box to the left of each parameter to bring a popup window that will allow the parameter to be changed.

- Time (24hr format)—Adjust Hour, Minute or Seconds
- Date (MM DD, YYYY format)—Adjust Month, Day or Year
- Password—Reset the password (up to 5 characters, alphanumeric, case-sensitive; default is EXL)

## 2.2.3 Reports

This menu accesses the events records.

- Event Log—Up to 2048 time- and date-stamped events are captured in the log. The oldest record will be overwritten with a new record once the log reaches 2048 events.

### 2.2.4 Metering

This menu accesses the System Meter and Battery Meter.

**System Meter**

- Input volts (line-line) per phase
- Input amps (line-line) per phase
- Input frequency
- Bypass volts (line-line) per phase
- Bypass frequency
- DC bus voltage
- DC bus amps
- Output volts (line-line) per phase
- Output amps (line-line) per phase
- Output kVA% per phase
- Output kW% per phase
- Output power factor (PF) per phase
- Total kVA/kW
- Output frequency
- Bypass/Inverter sync window.

**Figure 6 System Meter menu**

**Battery Meter**

- DC volts per string
- Temperature, degrees Celsius, per string
- Battery commissioning date
- Operating time on DC source
- Discharge time
- Time remaining
- Charge %
- Amp-Hour, AH, consumed
- DC power

**Figure 7 Battery Meter menu**

## 2.2.5 Operation Menu

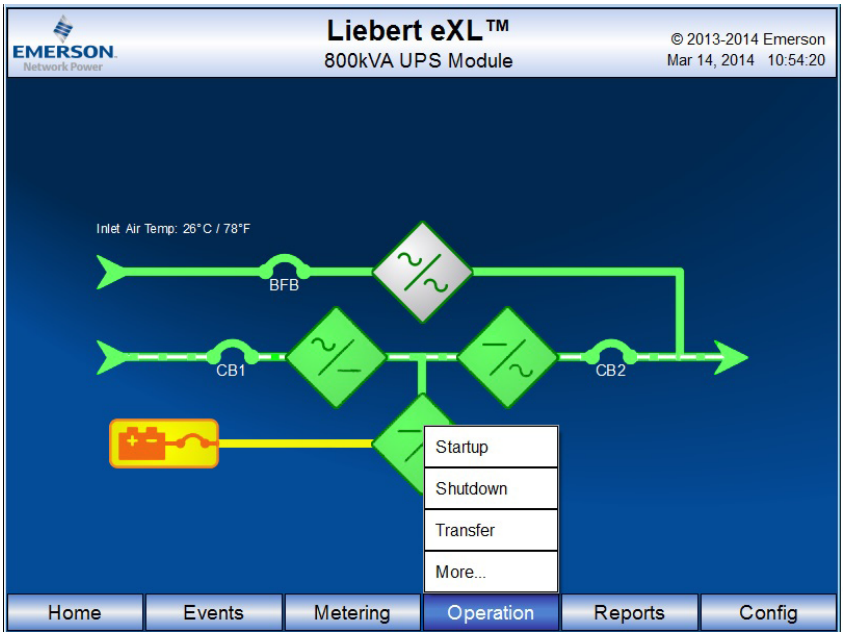
- Startup—Activates the module startup process
- Shutdown
  - UPS—Turns Off inverter, rectifier and trips all DC source breakers; transfers to bypass, if available.
  - System—Turns Off inverter, rectifier and trips all DC source breakers; Will shut down UPS.

# NOTICE

Risk of equipment damage. This command will result in the load being shut down.

- Transfer—Permits switching between UPS and Bypass mode.
- Battery Equalize—Starts/Stops Battery Equalize

**Figure 8 UPS Operation menu**



### 2.2.6 Reset

This button will reset any non-active latched events.

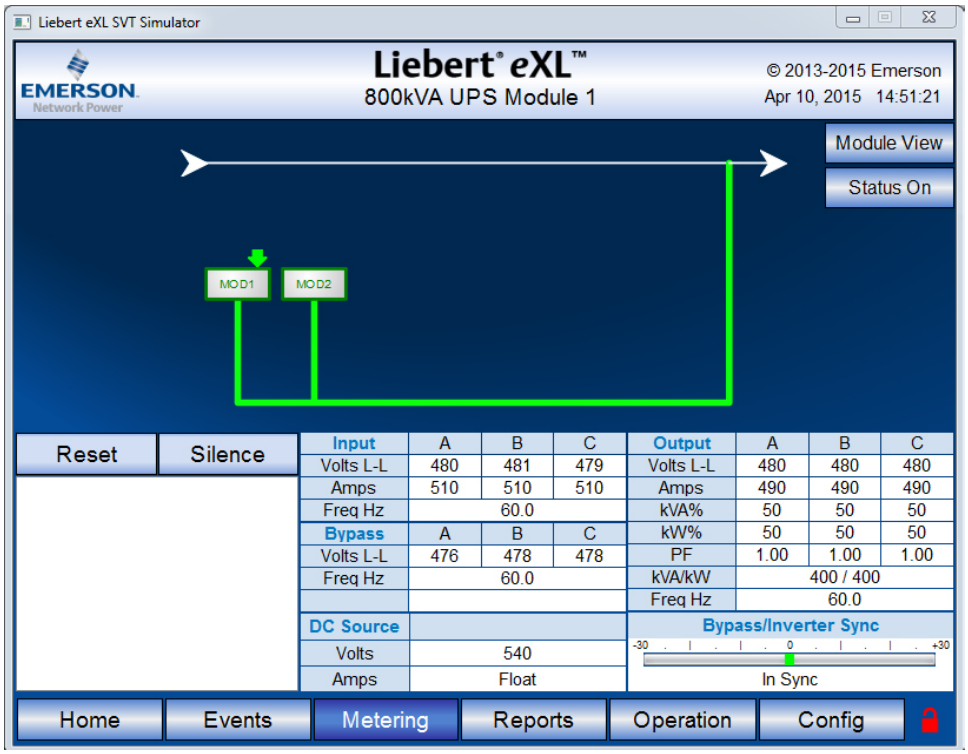
### 2.2.7 Silence

This button will silence the audible alarm.

### 2.2.8 System View—1+N Systems Only

System View will display the status of each of the system breakers (MOB's, MIB, MBB). It will display the system output information including the voltage, current, kVA/kW, frequency and number of modules in the system.

**Figure 9 Status View—1+N systems only.**



# 3.0 OPERATIONS

## 3.1 Manual Operations—Single-Module Systems

The Liebert *e*XL is designed to function while unattended by an operator. The system control logic automatically handles many important functions, as explained in **3.3 - Automatic Operations**. Other procedures must be performed manually.

Manual procedures available to the operator include startup, load transfers and shutdowns. These procedures are performed by using the touchscreen and some manually operated circuit breakers and switches.

This section lists typical step-by-step instructions. The touchscreen will list all steps required for the process, based on the unit's condition and other factors.

- Startup—including initial startup, recovering from input power failure, recovering from DC source shutdown and recovering from shutdowns for emergencies or maintenance.
- Load Transfers—including transfers from UPS to bypass and retransfers from bypass to the UPS system.
- Maintenance Bypass Load Transfers—including transfers from internal bypass to maintenance bypass and transfers from maintenance bypass to internal bypass.
- Shutdowns—including module shutdowns for maintenance and emergency shutdowns.

**NOTE**
*The following procedure assumes that the UPS installation inspection and initial startup have been performed by Liebert Services. An Emerson-authorized representative must perform the initial system startup to ensure proper system operation.*

### 3.1.1 Startup-Single Module System with CB2 Breaker Installed

**WARNING**
Risk of electrical shock. Can cause equipment damage, personal injury and death.
The following procedure provides power to the critical load distribution system. Verify that the critical load distribution is ready to accept power. Make sure that personnel and equipment are ready for the critical load distribution system to be energized.

**AVERTISSEMENT**
Risque de décharge électrique pouvant entraîner des dommages matériels, des blessures et même la mort.
La procédure suivante fournit de l'énergie au système de distribution de la charge critique. Vérifiez que ce système est prêt à être alimenté. Assurez-vous que le personnel et les équipements sont préparés pour la mise sous tension du système de distribution de la charge critique.

If the installation includes a Maintenance Bypass, power may already be supplied to the critical load equipment through the Maintenance Bypass. If there is no power to the critical load, apply power through the UPS bypass line per the following procedure.

During startup, power is supplied to the critical load through the UPS (internal) bypass line while the UPS system is being energized. Depending on the reason for the UPS system shutdown, power may be present in the bypass line. To determine this, check the Monitor/Mimic Display screen after control power is available.

**NOTE**
*If the system was shut down in response to an "Emergency Off", there may be alarm messages on the touchscreen that describe system conditions before (or at the time of) the shutdown. Some or all of the alarm conditions may have been resolved. Contact Liebert Services for assistance in clearing any remaining alarm messages.*

# WARNING

Risk of electrical shock and high short circuit current. Can cause equipment damage, personal injury and death.

If the UPS has been shut down for maintenance, verify that all of the UPS doors are closed and latched. All test equipment must be removed from the system. All electrical connections must be secure.

# AVERTISSEMENT

Risque de décharge électrique et de présence de courant de court-circuit élevé pouvant entraîner des dommages matériels, des blessures et même la mort.

Si l'alimentation sans coupure a été interrompue à des fins d'entretien, assurez-vous que toutes les portes du système ASC sont fermées et verrouillées. Tous les appareils de test doivent être retirés du système. Tous les branchements électriques doivent être serrés.

This section lists typical step-by-step instructions. The touchscreen will list all steps required for the process, based on the unit's condition and other factors.

1. Before applying power to the UPS modules, determine the location and position of the following circuit breakers and switches:
   - Input Circuit Breaker *—Verify that this breaker (**Figure 2**) is in the open position.
   - Module Battery Disconnect—Verify that this external breaker is open or tripped. If DC source cabinets are used, verify that breakers on all the cabinets are open.
   - Bypass Circuit Breaker *—Normally this circuit breaker (**Figure 2**) should be open. However, if the critical load is already supplied through this breaker, keep this breaker closed.
   - Output Circuit Breaker—This circuit breaker (**Figure 2**) should be open.

   *If remote breakers are used, these breakers will be located in the appropriate switch gear.
2. Provide power to the UPS controls of the UPS module starting up to permit the display touchscreen and system logic to function properly.

   Close all breakers feeding power to the Bypass Circuit Breaker and Input Circuit Breaker of the unit.
3. Start the module:
   a. Press the "Operation."
   b. Pop-up window will appear to enter the password. Enter the password (see **Preferences on page 11**)
   c. Press the "Startup" menu button
   d. The message "Close BFB" will appear in the multipurpose window.
   e. Close the BFB breaker. The message "Press OK to turn on SBS" will appear.
   f. Press OK to continue. This will energize the load on the UPS internal bypass.
   g. The "Press OK to start Rectifier" message will appear.
   h. Press "OK." This will start the UPS's rectifier. Load is still on internal bypass.

      The DC Bus will charge up.

      The message "Close CB1" will appear in multipurpose window.
   i. Close the CB1 breaker. The rectifier will start power walk-in.
   j. The message "Press OK to turn Inverter on" will appear.
   k. Press "OK." The rectifier will be On and the Inverter will be on standby. Load is still on internal bypass.
   l. The message "Press OK to DC/DC Converter on" will appear.
   m. Press OK to continue.
   n. The message "Press OK to close all Battery Breaker(s)" will appear.
   o. Press OK to continue.
   p. Close all battery/DC breakers. The UPS will stay in this mode until all breakers are closed.

      If the DC sources are not ready to be started up, skip this command. The DC breakers can be closed individually from the startup command later (see **2.2.5 - Operation Menu**).

**NOTE**

*The DC source charge current may increase quickly, but should slowly decrease. If the system is recovering from a DC source shutdown or an input power failure, the UPS rectifier will be recharging the DC source. Recharge current can be more than 100A. The maximum allowable recharge current for any unit depends on the kVA rating and the DC source recharge current limit.*

q. The message “Press OK to transfer to UPS” will appear.
r. Press “OK.”
s. The message “Close CB2” will appear. (if CB2 is not installed, this step will be skipped)

The load is now energized from the UPS inverter.

# NOTICE

Risk of equipment damage. If an abnormal situation occurs during this startup procedure, open the input circuit breaker and investigate the problem. Call Liebert Services if help is required.

# WARNING

Risk of electric shock, explosive reaction, hazardous chemicals and fire. Can cause equipment damage, personal injury and death.

Do not use equalize charging with valve-regulated, lead-acid batteries. Refer to the battery manufacturer's manual, available on the manufacturer's Web site, for specific information about equalize charging.

# AVERTISSEMENT

Risque de décharge électrique, de réaction explosive, d’incendie et d’exposition à des produits chimiques dangereux pouvant entraîner des dommages matériels, des blessures et même la mort.

N’utilisez pas de charge d’égalisation avec les batteries au plomb-acide à régulation par soupape. Reportez-vous au manuel du fabricant des batteries, disponible sur le site Web du fabricant, pour obtenir des renseignements précis sur la charge d’égalisation.

### 3.1.2 Startup—Single Module System with No CB2 breaker

1. Start the module:
   a. Depending on the site's circuit breaker configuration, either close MIB and open MBB or close MOB prior to UPS startup.
   b. Press the "Operations" menu button.
   c. Pop-up window will appear to enter the password. Enter the password (see **Preferences on page 11**)
   d. Press the "Startup" menu button.
   e. The "Press OK to start Rectifier" message will appear.
   f. Press "OK." This will start the UPS's rectifier.
      The DC Bus will charge up
   g. The message "Close CB1" will appear in the multipurpose window.
   h. Close the CB1 breaker. The rectifier will start power walk-in.
   i. The message "Close BFB" will appear in the multipurpose window.
   j. Close the BFB breaker. The message "Press OK to turn on SBS" will appear.
   k. Press OK to continue. This will energize the load on the UPS internal bypass.
   l. The message "Press OK to turn Inverter on" will appear.
   m. Press "OK." The rectifier will be On and the inverter will be on standby. Load is still on internal bypass.
   n. The message "Press OK to DC/DC Converter on" will appear.
   o. Press "OK" to continue.
   p. The message "Press OK to close all Battery Breaker(s)" will appear.
   q. Press "OK" to continue.
   r. Close all battery/DC breakers. The UPS will stay in this mode until all breakers are closed.
      If the DC sources are not ready to be started up, skip this command. The DC breakers can be closed individually from the startup command later (see **2.2.5 - Operation Menu**).
   s. The message "Press OK to transfer to UPS" will appear.
   t. Press "OK."

The load is now energized from the UPS inverter.

### 3.1.3 Load Transfer and Retransfer-Single Module System

Changing the load from the UPS system to the UPS bypass is called a transfer. Changing the load from UPS bypass to the UPS system is called a retransfer. Note that the UPS system control logic can initiate automatic load transfers and retransfers. Refer to **3.3 - Automatic Operations**.

#### Transfer Procedure

1. Press the "Operation" then "Transfer" menu buttons on the touchscreen. The message "Press OK to transfer to Bypass" will appear in the multipurpose window.
2. Press the "OK" button. This will transfer the load from the UPS to the bypass.
   If the UPS output is not synchronized with the bypass, the module will not allow a transfer.

#### Retransfer Procedure

1. Press the "Operation" then "Transfer" menu buttons on the touchscreen. The message "Press OK to transfer to UPS" will appear in the multipurpose window.
2. Press the "OK" button. This will transfer the load from the Bypass to the UPS.
   If the UPS output is not synchronized with the bypass, the module will not allow a retransfer.

### 3.1.4 Maintenance Bypass Load Transfers-Single Module System

Follow these instructions to manually transfer the load between the Maintenance Bypass and the UPS bypass line. Do not transfer the load between the Maintenance Bypass and the UPS module (inverter) output. Use the Monitor/Mimic Display screen to verify that the UPS bypass line is available.

# NOTICE

Risk of equipment damage. Failing to follow the proper sequence when operating any circuit breaker may cause damage to the connected equipment. Operating a Maintenance Bypass circuit breaker out of sequence could cut off power to the critical load.

# NOTICE

Risk of equipment damage. The UPS must be on internal bypass before performing the following procedures and operating the MIB or the MBB, or damage to the UPS may occur and the critical load may be lost.

After the UPS been transferred to bypass (see **3.1.3 - Load Transfer and Retransfer-Single Module System**), the "OK to transfer" lamp on the key-release unit will light.

#### Maintenance Bypass Load Transfers-Single Module System: If Load is on UPS Bypass

After the UPS been transferred to bypass (see **3.1.3 - Load Transfer and Retransfer-Single Module System**), the "OK to transfer" lamp on the key-release unit will light.

**NOTE**

*If the maintenance bypass cabinet or switchboard has any other type of custom interlock, follow the specific instructions for that interlock system to remove the key.*

1. If using a key interlock system, depress the key-release unit push button, turn the key and remove from key-release unit.

**NOTE**

*The UPS is now locked in bypass and cannot be retransferred to the Inverter until the key is reinserted.*

2. If using a key interlock system, insert the key into the lock for the Maintenance Bypass Breaker (MBB); retract the bolt.
3. Close the Maintenance Bypass Breaker (MBB).

# NOTICE

Risk of improper operation sequence. May cause equipment damage.

Failure to close the Maintenance Bypass Breaker (MBB) will interrupt power to the load.

4. Open the Maintenance Isolation Breaker (MIB). The UPS is now isolated from the critical load and the load is now on Maintenance Bypass.
5. If using a key interlock system, remove the key from the lock for the Maintenance Isolation Breaker (MIB).
6. If the maintenance bypass cabinet or switchboard has an optional two-key interlock system, replace the key into the solenoid.
7. If UPS bypass shutdown is required, following instructions in Section **3.1.5 - Shutdown-Single Module UPS**.

### Maintenance Bypass Load Transfers-Single Module System: If Load is on Maintenance Bypass

1. Verify that power is available to the module's bypass and rectifier inputs.
2. Verify that the module is started and in Bypass Mode.
3. If using a key interlock system:
   a. Depress the key-release unit push button
   b. Turn the key and remove it from the key-release unit.

**NOTE**
*The UPS is now locked in bypass and cannot be retransferred to the Inverter until the key is returned.*

4. If using a key interlock system:
   a. Insert the key into the lock for the Maintenance Isolation Breaker (MIB)
   b. Retract the bolt.
5. Close the Maintenance Isolation Breaker (MIB).

**NOTICE**

Risk of improper operation sequence. May cause equipment damage.

Failure to close the Maintenance Isolation Breaker (MIB) will interrupt power to the load.

6. Open the Maintenance Bypass Breaker (MBB). Load is now on UPS Internal Bypass.
7. If using a key interlock system, remove the key from the lock for the Maintenance Bypass Breaker (MBB) to lock it open.
8. If the maintenance bypass cabinet or switchboard has an optional two-key interlock system, insert the key into the solenoid.

The UPS system may now be transferred from bypass to UPS (see **3.1.3 - Load Transfer and Retransfer-Single Module System**).

## 3.1.5 Shutdown-Single Module UPS

Perform a Module Shutdown to remove power from a UPS module.

Read all warnings in **5.0 - Maintenance** before performing any maintenance on the Liebert *e*XL UPS. These warnings and cautions must be observed during any work on the UPS.

**NOTE**
*Service and maintenance work must be performed only by properly trained and qualified personnel and in accordance with applicable regulations as well as with manufacturers' specifications.*

Use the module Monitor/Mimic Display to determine the operating condition of the UPS module.

### UPS Shutdown

**NOTE**
*This shutdown turns Off the inverter and the rectifier and trips all DC source breakers. The critical load will transfer to bypass if bypass is available.*

1. Press the "Operations" then "Shutdown" menu buttons on the touchscreen. The Shutdown screen will appear in the multipurpose window.
2. Press the "UPS" button. This brings up a warning that pressing "OK" will shut down the UPS and, if bypass is not available, drop the load.
   a. Press "OK" to continue Shutdown process.
   b. Press "Exit" to abort shutdown.
3. Pop-up will appear "Proceed with UPS Shutdown?"
   a. Press "Yes" to shutdown system.
   b. Press "Cancel" to abort shutdown.
4. Once shutdown is complete, a message "Shutdown complete" will appear. Press "Exit" to return to main screen.

### UPS System Shutdown

**NOTE**
*This shutdown turns Off the inverter and the rectifier and trips all DC source breakers. This will shut down the UPS completely.*

1. Press the "Operations" then "Shutdown" menu buttons on the touchscreen. The Shutdown screen will appear in the multipurpose window.
2. Press the "System" button. This brings up a warning that pressing "OK" will shut off the UPS output completely - Load Drop will occur
   a. Press "OK" to continue Shutdown process.
   b. Press "Exit" to abort shutdown.
3. Pop-up will appear "Proceed with System Shutdown?"
   a. Press "Yes" to shutdown system.
   b. Press "Cancel" to abort shutdown.
4. Once shutdown is complete, a message "Shutdown complete" will appear. Press "Exit" to return to main screen.

## 3.2 Manual Operations, 1+N Systems

### 3.2.1 Startup—1+N Module System with CB2 Breaker Installed

# WARNING
Risk of electrical shock. Can cause equipment damage, personal injury and death.

The following procedure provides power to the critical load distribution system. Verify that the critical load distribution is ready to accept power. Make sure that personnel and equipment are ready for the critical load distribution system to be energized.

# AVERTISSEMENT
Risque de décharge électrique pouvant entraîner des dommages matériels, des blessures et même la mort.

La procédure suivante fournit de l'énergie au système de distribution de la charge critique. Vérifiez que ce système est prêt à être alimenté. Assurez-vous que le personnel et les équipements sont préparés pour la mise sous tension du système de distribution de la charge critique.

If the installation includes a Maintenance Bypass, power may already be supplied to the critical load equipment through the Maintenance Bypass. If there is no power to the critical load, apply power through the UPS bypass line per the following procedure.

During startup, power is supplied to the critical load through the UPS (internal) bypass line while the UPS system is being energized. Depending on the reason for the UPS system shutdown, power may be present in the bypass line. To determine this, check the Monitor/Mimic Display screen after control power is available.

**NOTE**
*If the system was shut down in response to an "Emergency Off", there may be alarm messages on the touchscreen that describe system conditions before (or at the time of) the shutdown. Some or all of the alarm conditions may have been resolved. Contact Liebert Services for assistance in clearing any remaining alarm messages.*

# WARNING
Risk of electrical shock and high short circuit current. Can cause equipment damage, personal injury and death.

If the UPS has been shut down for maintenance, verify that all of the UPS doors are closed and latched. All test equipment must be removed from the system. All electrical connections must be secure.

# AVERTISSEMENT

Risque de décharge électrique et de présence de courant de court-circuit élevé pouvant entraîner des dommages matériels, des blessures et même la mort.

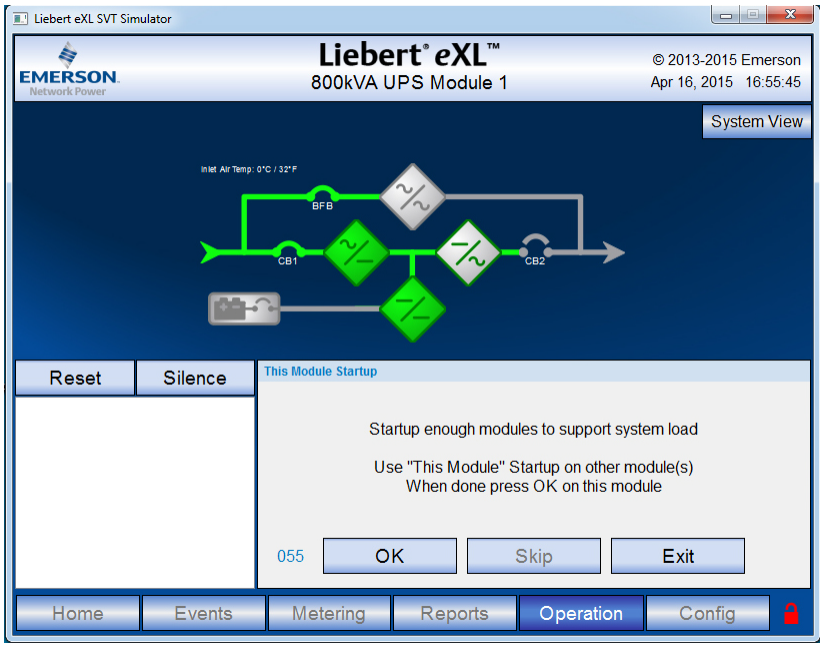
Si l'alimentation sans coupure a été interrompue à des fins d'entretien, assurez-vous que toutes les portes du système ASC sont fermées et verrouillées. Tous les appareils de test doivent être retirés du système. Tous les branchements électriques doivent être serrés.

This section lists typical step-by-step instructions. The touchscreen will list all steps required for the process, based on the unit's condition and other factors.

1. Before applying power to the UPS modules, determine the location and position of the following circuit breakers and switches:
   - Input Circuit Breaker *—Verify that this breaker is in the open position (see **Figure 2**).
   - Module Battery Disconnect-Verify that this external breaker is open or tripped. If DC source cabinets are used, verify that breakers on all the cabinets are open.
   - Bypass Circuit Breaker *—Normally this circuit breaker should be open (see **Figure 2**). However, if the critical load is already supplied through this breaker, keep this breaker closed.
   - Output Circuit Breaker—This circuit breaker should be open (see **Figure 2**).

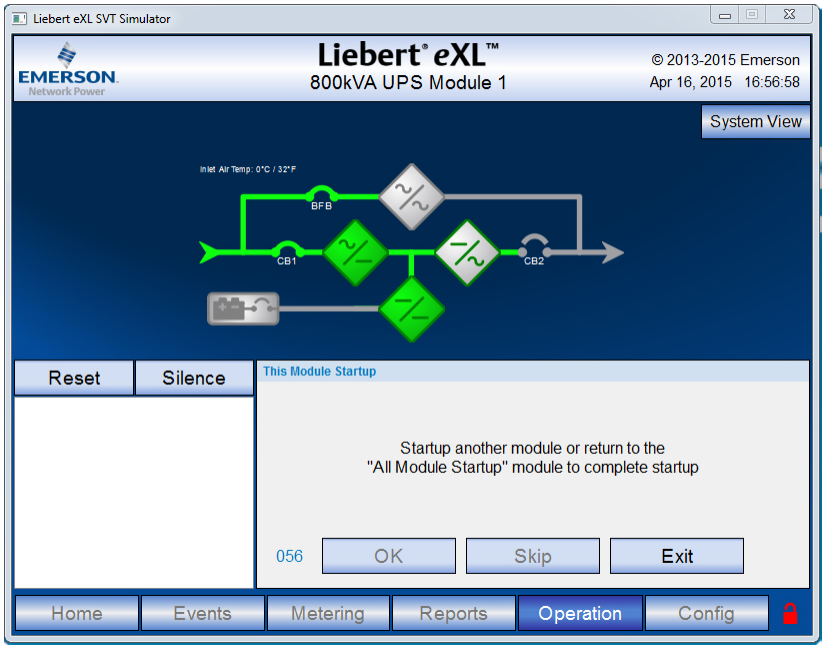
   * If remote breakers are used, these breakers will be located in the appropriate switch gear.
2. Provide power to the UPS controls of each UPS module starting up to permit the display touchscreen and system logic to function.
3. Startup the modules via the Module 1 HMI
   a. Depending on the site's circuit breaker configuration, either close MIB and open MBB or open all MOB's prior to UPS startup.
   b. Press "Operation."
   c. Enter the password in the pop-up window (see **Preferences on page 11**).
   d. Press the "Startup" menu button.
   e. Press "All Modules."
   f. The message "Press OK to start Rectifier" message will appear.
   g. Press "OK." This will start the UPS's rectifier. The DC Bus will charge up and the message "Close CB1" will appear.
   h. Close CB1. The rectifier will start power walk-in.
   i. The message "Close BFB" will appear. Close the BFB.
   j. The message "Press OK to turn Inverter on" will appear.
   k. Press "OK." The rectifier will be on and the inverter will be on standby.
   l. The message "Press OK to turn DC/DC Converter on" will appear.
   m. Press "OK" to continue.
   n. The message "Press OK to close all Battery Breaker(s)" will appear.
   o. Press "OK" to continue.
   p. The screen shown in **Figure 10** will appear. Go to the next module to startup in the system.

**Figure 10 1+N Next Module Startup Display**




q. At the HMI of the next module, select “Operation” and enter the password used in **Step c**.
r. Press the “Startup” menu button.
s. Press “This Module”.
t. Repeat **Steps f** through **o** above.
u. Once complete the screen display in **Figure 11** will appear on the module.

**Figure 11 1+N return to Module 1 display**




4. If starting up more modules, move to the next module and perform **Steps a** through **d** below. If finished starting modules, proceed to **Step 5**,
   a. On the next module’s HMI, select “Operation” and enter the password used in **Step 3 c** above.
   b. Press the “Startup” menu button.
   c. Press “This Module.”
   d. Repeat **Steps f** through **o** above.

5. On Module 1, press OK to indicate that all modules necessary to support the connected load have been started.
6. The Module 1 HMI will prompt the operator to "Close MOB on enough modules to support system load" and "Press OK to continue."
7. Close the module systems' MOB's.
8. The message "Press OK to turn on the SBS of every module" will appear. Press "OK" to turn On all module SBS's.
9. The message "Press OK to transfer all modules to UPS" will appear. Press "OK" to transfer all modules to UPS.
10. The message "Close CB2 on enough modules to support system load" and "Press OK to complete transfer."
11. Close all modules' CB2 breakers, then press "OK" to continue

Startup is now complete and the load is on the UPS. If the UPS modules have the option without CB2, skip **Steps 10** and **11** above.

### 3.2.2 Load Transfer-1+N System: Remove a UPS from System (Collective)

1. Press the "Operation" then "Transfer" then "This Module" menu buttons on the touchscreen
2. If the system has enough capacity to turn Off the unit, the message "Press OK to remove module from the collective" will appear. Press "OK." CB2 will open on this module.

**NOTE**

*If disengaging the UPS from the system would cause an overload on the other UPS units in the system, the "Remove Inverter" command will be disabled.*

3. To isolate the UPS from the critical bus, open the MOB breaker.

### 3.2.3 Load Transfer-1+N System: Add a UPS to the System (Collective)

1. Provide power to all the UPS controls of the module to be added to permit the display touchscreen and system logic to function.
2. Press "Operation."
3. Enter the password in the pop-up window (see **Preferences on page 11**).
4. Press the "Startup" menu button.
5. Press "This Module."
6. Close the module's MOB.
7. The message "Press OK to start Rectifier" will appear.
8. Press "OK." This will start the UPS's rectifier. The DC bus will charge up and the message "Close CB1" will appear.
9. Close CB1. The rectifier will start power walk-in.
10. The message "Close BFB" will appear. Close the BFB.
11. The message "Press OK to turn Inverter on" will appear.
12. Press "OK." The rectifier will be On and the inverter will be on standby.
13. The message "Press OK to turn DC/DC Converter on" will appear.
14. Press "OK" to continue.
15. The message "Press OK to close all Battery Breaker(s)" will appear.
16. Press "OK" to continue.
17. The message "Press OK to add module to Collective" will appear. Press "OK."
18. Close CB2.
19. Press "Exit."
20. Press "Operation" then "Transfer" then "This Module" to transfer this module to UPS and include in the collective 1+N system.

**NOTE**

*If the UPS is not synchronized with the other units in the system, the "Connect Inverter" command will be disabled.*

### 3.2.4 Load Transfer-1+N System: Transfer System to Bypass

1. Press "Operation" then "Transfer" then "All Modules."
2. If the UPS outputs are synchronized with their bypass, press OK to "Transfer all modules to Bypass." This will transfer the load on every module to bypass.

**NOTE**
*If this UPS is not part of the collective, the "Transfer all modules to bypass" command will not be activated.*

**NOTE**
*The load will now be on static bypass in each UPS.*

### 3.2.5 Load Transfer-1+N System: Transfer System to Inverter

1. Verify that all the UPS units are On and the inverters are in Standby Mode and on bypass.
2. Press "Operation" then "Transfer" then "All Modules."
3. Press "OK" to transfer all modules to UPS. This will transfer the load to the inverters on all UPS modules.

**NOTE**
*If the UPS is not synchronized with the other units in the system, the "Transfer all modules to Inverter" command will not be activated.*

### 3.2.6 Maintenance Bypass Load Transfers-1+N Module System

Follow these instructions to manually transfer the load between Maintenance Bypass and the UPS bypass line. Do not transfer the load between Maintenance Bypass and the UPS module inverter output. Use the Monitor/Mimic Display screen to verify that the UPS bypass line is available.

# NOTICE

Risk of improper operating sequence. Can cause equipment damage.

Failing to follow the proper sequence when operating any circuit breaker may cause damage to the connected equipment. Operating a Maintenance Bypass circuit breaker out of sequence could cut off power to the critical load.

# NOTICE

Risk of improper load transfer. Can cause equipment damage.

The UPS must be on internal bypass before performing the following procedures and operating the MIB or the MBB, or damage to the UPS may occur and the critical load may be lost.

### Maintenance Bypass Load Transfers-1+N Module System: If Load is on UPS Bypass

1. Transfer the UPS system to bypass (see **3.2.4 - Load Transfer-1+N System: Transfer System to Bypass**). The "OK to transfer" lamp on the key-release unit will light.

**NOTE**
*If the maintenance bypass cabinet or switchboard has any other type of custom interlock, follow the instructions for that interlock systems to remove the key.*

2. If using a key interlock system:
   a. Press the key-release unit push button
   b. Turn the key and remove it from key-release unit.

**NOTE**
*The UPS is now locked in bypass and cannot be retransferred to the inverter until the key is reinserted.*

3. If using a key interlock system, insert the key into the lock for the Maintenance Bypass Breaker (MBB); retract the bolt.
4. Close the MBB.

# NOTICE

Risk of improper operation sequence. May cause equipment damage.

Failure to close the MBB will interrupt power to the load.

5. Open the Maintenance Isolation Breaker (MIB). The UPS system is now isolated from the critical load and the load is now on Maintenance Bypass.
6. If using a key interlock system, remove the key from the lock for the MIB.
7. If the maintenance bypass cabinet or switchboard has an optional, two-key interlock system, insert the key into the solenoid.
8. If UPS bypass shutdown is required, follow the instruction in **3.2.8 - Shutdown—1+N UPS: UPS Module System Shutdown (Remove UPS Module from the Collective)**

### Maintenance Bypass Load Transfers—1+N Module System: If Load is on Maintenance Bypass

1. If the UPS modules are Off, start the system. Refer to **3.2.1 - Startup—1+N Module System with CB2 Breaker Installed**.
2. Place all the UPS units in the system in Bypass Mode. Refer to **3.2.4 - Load Transfer-1+N System: Transfer System to Bypass**.
3. If using a key interlock system:
   a. Press the key-release unit push button.
   b. Turn the key and remove from key-release unit.

**NOTE**
*The UPS is now locked in bypass and cannot be retransferred to the inverter until the key is reinserted.*

4. If using a key interlock system, insert the key into the lock for the Maintenance Isolation Breaker (MIB); retract the bolt.
5. Close the MIB.

# NOTICE

Risk of improper operation sequence. May cause equipment damage.

Failure to close MIB will interrupt power to the load.

6. Open the Maintenance Bypass Breaker (MBB). The load is now on UPS internal bypass.
7. If using a key interlock system, remove the key from the lock for the MBB to lock it open.

8. If the maintenance bypass cabinet or switchboard has an optional two-key interlock system, insert the key into the solenoid.

The UPS system can now be transferred from bypass to UPS (see **3.2.5 - Load Transfer-1+N System: Transfer System to Inverter**).

### 3.2.7 Shutdown—1+N UPS: UPS Module Inverter Shutoff

Perform a module shutdown procedure to turn Off a single UPS module inverter in the system.

Read all warnings in **5.0 - Maintenance** before performing any maintenance on the UPS. These warnings and cautions must be observed during any work on the UPS.

**NOTE**
*This shutdown turns Off the inverter and the rectifier and trips all DC source breakers. Transfers to bypass if available.*

1. Press “Operation” then “Shutdown” then “This Module” on the module to be turned Off.
2. The Press the “UPS” button to transfer the load to the Bypass Static Switch and shut off the inverter.
3. The message “Press OK to turn Off UPS” will appear. Press “OK.”
4. A pop-up window will appear with the message “Proceed with This Module's UPS Shutdown?” Press “Yes” to continue shutting down the UPS.
5. Open the module MOB.

### 3.2.8 Shutdown—1+N UPS: UPS Module System Shutdown (Remove UPS Module from the Collective)

Perform a module shutdown procedure to remove power from a single UPS module in the system.

Read all warnings in **5.0 - Maintenance** before performing any maintenance on the UPS. These warnings and cautions must be observed during any work on the UPS.

**NOTE**
*This shutdown turns Off the inverter and the rectifier and trips all DC source breakers. This will shut down the UPS completely.*

1. Press “Operation” then “Shutdown” then “This Module” on the module to be turned off. The shutdown screen will appear.
2. Press the “System” button to shut down the UPS, including the Bypass Static Switch.
3. The message “Press OK to turn Off the UPS and bypass” will appear. Press “OK.”
4. A pop-up window will appear with the message “Proceed with This Module’s System Shutdown?” Press “Yes” to continue shutting down the UPS.
5. Open the module MOB.

### 3.2.9 Shutdown—1+N System Shutdown

Perform a system shutdown procedure when you want to remove power from the entire UPS system.

Read all warnings in **5.0 - Maintenance** before performing any maintenance on the UPS. These warnings and cautions must be observed during any work on the UPS.

**NOTE**
*Service and maintenance must be performed only by properly trained and qualified personnel and in accordance with applicable regulations as well as with manufacturer's specifications.*

1. If an external, wraparound bypass is installed, perform the following steps; otherwise skip to **Step 2**.
   a. If using a key interlock system:
      1. Press the key-release unit push button.
      2. Turn the key and remove it from the key-release unit.

**NOTE**
*The UPS system is now locked in bypass and cannot be transferred until the key is returned.*

   b. If using a key interlock system, insert the key into the lock for the MBB; retract the bolt.
   c. Close the MBB.

**NOTE**
*Failure to close the Maintenance Bypass Breaker (MBB) will interrupt power to the load.*

   d. Open the MIB. The UPS system is now isolated from the critical load and the load is now on Maintenance Bypass.
   e. If using a key interlock system, remove the key from the lock for the MIB.
   f. If the maintenance bypass cabinet or switchboard has an optional two-key interlock system, insert the key into the solenoid.
2. On any module, press "Operation" then "Shutdown" then "All Modules." The following message will appear: "Press OK to turn off the UPS and bypass of every module. Load drop will occur."
3. Press "OK." The shutdown screen will appear.
4. The pop-up message: "Proceed with All Modules Shutdown?" will appear. Press "Yes" to continue the shutdown.
5. The message "Press OK to proceed with shutdown" will appear.
6. Press "OK."
7. All the UPS breakers—CB1, CB2, BFB and DC source—will open. The message "Open all MOB's" will appear.
8. Open all the MOB breakers to isolate the UPS units from each other.
9. To isolate the system, open all the breakers and utility feeds to the bypass and rectifier inputs.

## 3.3 Automatic Operations

The Liebert *e*XL is designed to function while unattended by an operator. The system control logic monitors the performance of the UPS, the availability of power sources and the current required by the critical load.

The system control logic:

- Determines what overload conditions can be sustained without a transfer to bypass.
- Initiates an automatic transfer to bypass to sustain an overload or when selected UPS faults occur.
- Can initiate an automatic retransfer to the UPS after an overload has been cleared.
- Initiates an automatic transfer to bypass and emergency module shutdown when specified UPS faults occur.

### 3.3.1 Overloads

The UPS is capable of sustaining full output voltage (±2% of the nominal voltage) for overload conditions that remain within (under) the Current versus Time curve of overload capacity (**Figure 16**). Note that the time scale is not linear.

For high current demands of short duration (momentary overloads) the critical load is supplied simultaneously by both the UPS and the bypass line. Whenever an overload condition occurs, the cause of the overload should be determined. If an overload condition exceeds the overload capacity, the UPS initiates an automatic load transfer to the bypass line.

For overloads above the Input Current Limit, a DC source, such as a battery system or a generation source must be available. The Input Current limit has a default setting of 125% rated output current.

### 3.3.2 Automatic Transfers to Bypass

The UPS will initiate an automatic load transfer to the bypass line if an overload condition exceeds the current-versus-time curve of overload capacity or if specified UPS faults occur.

The Overload Transfer and Output Undervoltage alarm messages will initiate an automatic transfer to bypass and the Load On Bypass message will be displayed. The active event window will display the Automatic Transfer to Bypass message. Other UPS faults will initiate an automatic transfer to bypass followed immediately by the shutdown and isolation of the UPS. Refer to **3.3.3 - Automatic Transfers to Bypass, UPS Faults**.

### 3.3.3 Automatic Transfers to Bypass, UPS Faults

For specified UPS faults, the control logic will initiate an automatic transfer to bypass followed immediately by a shutdown and isolation of the UPS. The output, DC source (MBD) and input circuit breakers are open. The bypass breaker will be closed if the bypass line is available. Note that the bypass line is usually not available during Low Battery Shutdown.

The following UPS faults will initiate an automatic transfer to bypass:

- DC Overvoltage Shutdown
- Inverter Fault
- Output Overvoltage and Undervoltage
- Overload Shutdown
- Equipment Overtemperature
- Rectifier Fuse Blown

**NOTE**

*A load transfer to the bypass line will be completed whenever an automatic transfer to bypass is initiated and the bypass line is available. If the OK to Transfer condition is present, the load transfer will be uninterrupted. If the Static Switch Unable alarm message is present for any reason, the automatic transfer will be interrupted for 40 to 120 milliseconds. Because of the reliability of the UPS components, an interrupted load transfer is a very unlikely occurrence.*

Some installations may include a Remote Emergency Power Off mode that can be initiated automatically by a contact closure in the critical load equipment.

### 3.3.4 Automatic Retransfers to UPS

The following conditions will prevent an automatic retransfer of the critical load from the bypass source to the UPS inverter:

**The condition *Load on UPS* is inactive.**

**Bypass conditions are outside the range** for a manual transfer or the current load would cause the inverter(s) to be in an overload condition.

**The UPS module rectifier or inverter is not operating.**

**The static bypass switch is not operating properly as indicated by:**

- SBS SCR Shorted
- Bypass Sync Error

**The inverter is not operating properly as indicated by:**

- Inverter Output Breaker (CB2) Open Fail
- Inverter Output Breaker (CB2) Close Fail

**The cooling system is not operating properly or the ambient conditions are out of operating range as indicated by:**

- Equipment Overtemperature Limit

The load is connected to the maintenance bypass source as indicated by:

- Maintenance Bypass Breaker (MBB) Closed and Maintenance Isolation Breaker (MIB) Closed are active.
- Maintenance Bypass Isolator (QBP) Closed and Output Isolator (QOP) Closed are active.
- Maintenance Isolator (Q3) Closed and Output Isolator (Q4) Closed are active.
- Transfer to Inverter Inhibited is active.
- The number of retransfers has exceeded the maximum allowed retransfers in one hour. This values ranges from 0 to 5 retransfers per hour and is user-settable. The default is 5.

**NOTE**
*If the possibility of the UPS system initiating an automatic retransfer is not desired, this can be set during the initial commissioning or by calling your local Liebert Services representative.*

# 4.0 OPTIONS

**NOTE**
*These items must be enabled by service before they become functional. If a feature is disabled, the feature will not be available and the menu item will not be displayed.*

## 4.1 Input Contact Isolator Board

The Input Contact Isolator Board (ICI) provides a Liebert *e*XL module interface for up to eight external user alarm or message inputs to be routed through the *e*XL's alarm network. The eight contacts are normally open dry contacts. When a contact closes, an event is triggered.

**NOTE**
*Up to two (2) ICI's can be installed in a Liebert eXL.*

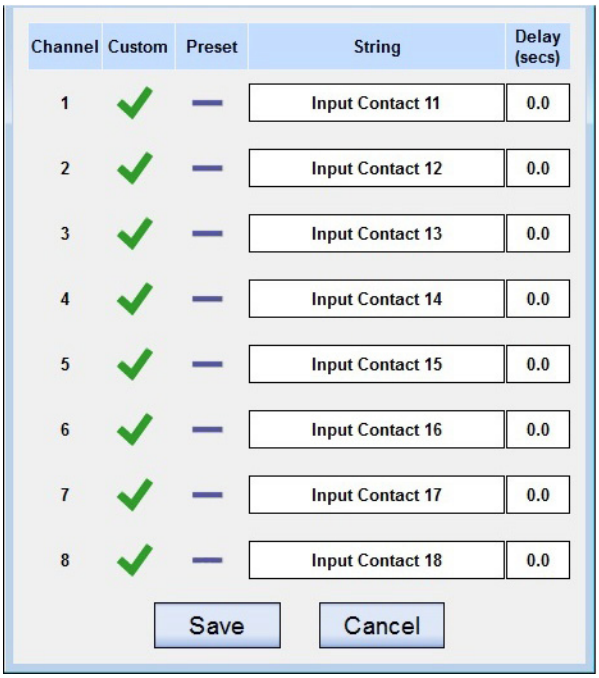
The Input Contact Isolator options are configured through the Input Contact Isolator dialog box, which is accessed from the Option Settings under Config menu on the HMI touchscreen display. The Input Contact Isolator dialog box contains eight choices to match the eight channel input board. Each button can be labeled to identify the event associated with the contact. When the dialog box is accessed, each button flashes to display the Input Contact Isolator number and the user entered label. This label also appears in the Display Panel when an event related to an Input Isolator Connector is triggered.

The Input Contact Isolator dialog box allows:

- Labeling the input contact assignments for the setup.
- Setting the delay for an external event triggering an alarm.
- Reviewing the isolator contact assignments, once the labels are entered.

The delay allows setting the number of seconds that a condition must exist before it will trigger an alarm.

**Figure 12 Input Contact Isolator dialog box**



To configure the Input Contact Isolator relays:

1. Press Option Settings from the Config menu.
2. Press which Input Contact Isolator is to be configured. The Input Contact Isolator dialog box is displayed.
   - Assignment-Custom, Preset (default: “Input Contact” XY)
   - Delay, sec-0 to 99.9 (default: 0)
   - Message-Custom: 0-19 characters
3. To assign labels for each channel:
   a. Press Preset for default labels and associated action (see **Table 1**).
   b. For Custom labels
      1. Press Custom radio button.
      2. Click on Input Contact XY button. A keyboard is displayed to allow naming alarms.
      3. Enter the name of the alarm set for that input. For example, a fan problem could be indicated by naming the button FAN.
4. Press OK on the keyboard to keep the label.
5. Press DELAY.
   a. A keypad is displayed, prompting for a delay time, in seconds, for a condition to exist before the alarm is triggered.
   b. Enter the delay value. The range for the values are from 0 (zero) to 99.9 seconds.
   c. Press OK on the keypad to keep the setting. The value entered is displayed in the field adjacent to the corresponding input contact.
6. Repeat Steps 3 and 4 for each input contact.
7. Press SAVE after all input contacts have been configured.

**Figure 13 Optional Input Contact Isolator Board**

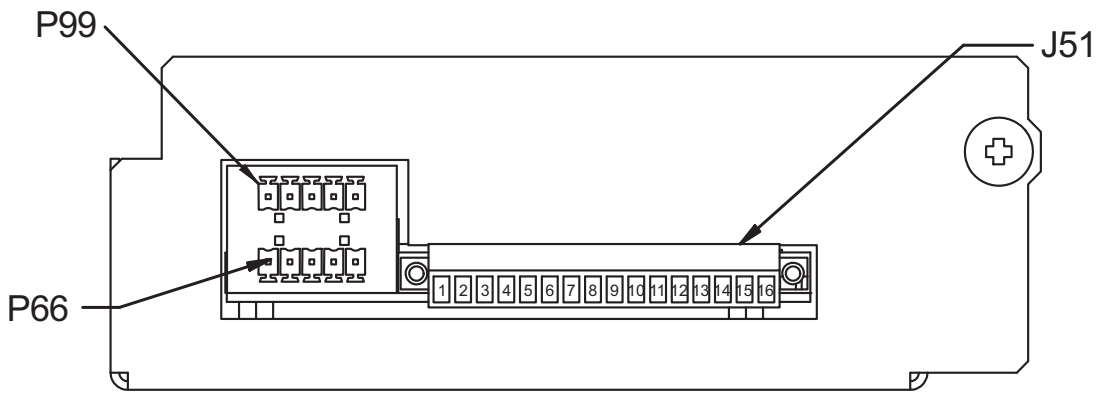



**Table 1 Input Contact Isolator Board pre-assigned values**

| Channel # | ICI #1 Pre-Assigned Label | ICI #2 Pre-Assigned Label |
|---|---|---|
| 1 | Reduced Rect ILimit | * Inhibit Intelligent Paralleling |
| 2 | Reduced Batt ILimit | None |
| 3 | Stop Battery Charge | None |
| 4 | Inhibit Auto Restart | None |
| 5 | * EcoMode Suspended | None |
| 6 | Inhibit BPSS | None |
| 7 | Manual Xfer to UPS | None |
| 8 | Manual Xfer to BPSS | None |

* EcoMode and Intelligent Paralleling are currently not supported.

**Table 2 Input Contact Isolator Board control wiring connections**

| Input Contact | Pin No. |
|---|---|
| 1 | 1 |
| | 2 |
| 2 | 3 |
| | 4 |
| 3 | 5 |
| | 6 |
| 4 | 7 |
| | 8 |
| 5 | 9 |
| | 10 |
| 6 | 11 |
| | 12 |
| 7 | 13 |
| | 14 |
| 8 | 15 |
| | 16 |

## 4.2 Programmable Relay Board

The Programmable Relay Board (PRB) provides a means to trigger an external device when an event occurs in the Liebert *e*XL. Each PRB has eight channels. Each channel has Form-C dry contacts rated at 1A @ 30VDC or 125VAC @ 0.45A.

Any alarm/event can be programmed to any channel or channels. Up to four (4) events can be programmed to a relay. If multiple events are grouped to one relay, any of the events becoming active will activate the channel. The same alarm/event can be programmed to more than one channel. Up to two Programmable Relay Boards can be installed in the Liebert *e*XL for a total of 16 channels. Programming is performed through the HMI touchscreen display.

**NOTE**
*Up to two (2) PRB's can be installed in the Liebert eXL.*

**Figure 14 Control wiring, Programmable Relay Board**

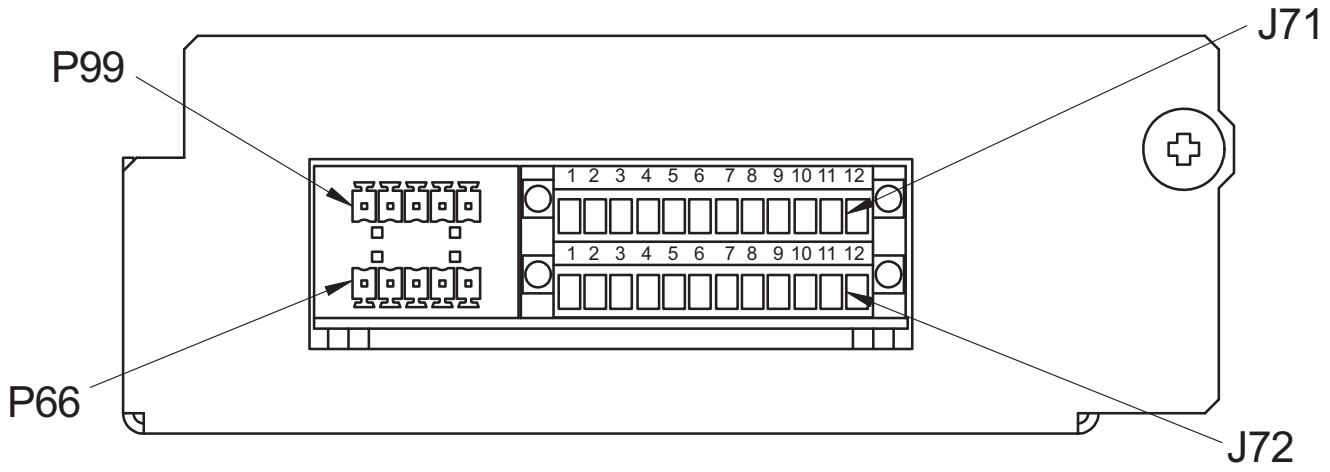


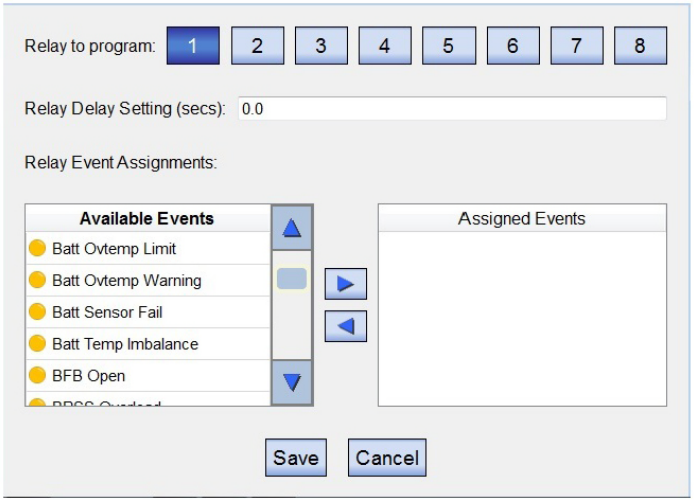
**Table 3 Programmable Relay Board pinout**

| Terminal Block | Channel | Pin No. | Common | Normally Closed | Normally Open |
|---|---|---|---|---|---|
| J71 | CH1 | 1-3 | 1 | 2 | 3 |
| | CH2 | 4-6 | 4 | 5 | 6 |
| | CH3 | 7-9 | 7 | 8 | 9 |
| | CH4 | 10-12 | 10 | 11 | 12 |
| J72 | CH5 | 1-3 | 1 | 2 | 3 |
| | CH6 | 4-6 | 4 | 5 | 6 |
| | CH7 | 7-9 | 7 | 8 | 9 |
| | CH8 | 10-12 | 10 | 11 | 12 |

### 4.2.1 Configuring the Programmable Relay Board Settings

1. Press Option Settings from the Config menu.
2. Press which Programmable Relay Board will be configured. The Programmable Relay Board dialog box is displayed.
3. Press the "Relay to program" channel.
4. Select an event from the Available Events list and then press the Right arrow button ▶ . Up to four (4) events may be selected. All selected events will appear in Assigned Events.
   To deselect an Assigned event, highlight the event and press the Left arrow button ◀ .
5. Set the delay that events must be present for the relay to activate
   - Delay, sec—0 to 99.9 (default: 0)
6. Repeat **Steps 3**, **4** and **5** for each relay.
7. Press SAVE to keep the settings.

**Figure 15 Programmable Relay Board menu**




## 4.3 Remote Alarm Status Panel RAS

The Remote Alarm Status Panel (RAS) uses LED status indicators that allow the operator to monitor the UPS.

The main purpose of the Remote Alarm Status Panel option is to report the status of the load and the UPS. To interpret the LED indicators, see **Table 4**.

**Table 4 RAS indicators**

| LED Name | LED Color | Meaning |
|---|---|---|
| Load on UPS | Green | The load is fully protected and no alarm conditions are present. The UPS is supplying uninterrupted power to the load. |
| Load on Bypass Alarm | Red | Power to the load is bypassing the UPS. The UPS is no longer supplying power to the load. |
| Battery Discharge Alarm | Red | The DC source is providing power to the UPS. |
| Low Battery Reserve Alarm | Red | DC source capacity is low and has reached the low-battery alarm setting. |
| Overload | Red | System load has exceeded the system rating. |
| Ambient Overtemp | Red | UPS inlet cooling air temperature has exceeded the specified limits. |
| System Summary Alarm | Red | An alarm has occurred at the UPS. |
| New Alarm Condition | Red | The New Alarm Condition LED lights when the UPS Alarm Condition LED has been triggered and has not been reset at the RAS. |

The RAS also includes:

1. An audible alarm
2. Lamp Test/Reset push button to test the LED indicators
3. Audio Reset push button to silence an audible alarm

### 4.3.1 Lamp Test/Reset Push button

The Lamp Test/Reset push button is used to verify that each LED indicator is in working condition and to reset an LED indicator that has been triggered by a condition at the load or UPS.

To test the LEDs, press the Lamp Test/Reset push button. This lights all of the LED indicators for visual inspection.

If an LED indicator does not respond to the lamp test, contact your local Emerson Network Power® representative for assistance.

To reset an activated LED, press the Lamp Test/Reset push button.

### 4.3.2 Audio Reset Push Button

The Audio Reset push button is used to silence an audible alarm that has been triggered and reset the alarm to activate on the next alarm condition.

After correcting the alarm condition, press the push button to reset the audible alarm.

## 4.4 Digital Load Bus Sync

### 4.4.1 System Description

Liebert's Load Bus Sync™ (LBS) option keeps the output of two or more independent Uninterruptible Power Systems in synchronization, even when the systems are operating from different power sources. The Liebert LBS works by synchronizing the Designates Slave System (DSS) to the output of the Designated Master System (DMS). There are no other connections between the logic or controls of either UPS. This ensures maximum system independence and reliability.

### 4.4.2 LBS Configurations

- Load Bus Sync—Enable or Disabled (default: Disable)
- LBS Master Select—Master or Slave (default: Slave)

**NOTE**
*The LBS settings permit proper operation with only one UPS set as the Master unit.*

- LBS Slave Priority – 0 to 7 (default: 0)

**NOTE**
*Setting of '0' will disable LBS Slave Priority*

### 4.4.3 Normal Operations

The LBS will synchronize the Designated Slave Systems (DSS) to the Designated Master System (DMS). The DSS will synchronize to the DMS output if the DMS is in Normal, Battery, Bypass or Maintenance Bypass Mode.

If the DSS transfers to Bypass Mode or Maintenance Bypass mode, the DMS will synchronize to the output bus of the DSS. This re-selection of master will occur automatically.

### 4.4.4 Slave Priority

When Slave Priority is enabled, the LBS system will work the same as Normal operations (See 4.4.2 - LBS Configurations except when the DMS disqualifies it bypass source. If the DMS's bypass is disqualified, the LBS system will synchronize to the output of the DSS with the lowest Slave Priority number that has a qualified bypass. The LBS system will synchronize back to the DMS when the DMS's bypass is qualified or all DSS's bypass are disqualified.

If a DSS LBS Slave Priority is set to "0", it will not assume the synchronization of the system if the DMS disqualifies its bypass.

### 4.4.5 Master System

The unit designated at power-up/reset to be the Master will monitor the LBS Sync Pulse line. If two units are designated as Master, the second designated Master Unit to come on-line will inhibit the LBS and synch to its own bypass.

The LBS Master will monitor the LBS Sync Pulse continuously; if the LBS Master detects that another unit has transferred to bypass, the LBS Master will follow the unit on bypass.

- Slave can no longer follow the Master; the Master must follow the Slave.

When the Master unit is following a Slave LBS Sync Signal, it will generate the LBS Active event.

If the Slave LBS Sync Pulse stops, the Master will resume generating the LBS Sync Pulse.

### 4.4.6 Slave System

Any unit designated as the Slave upon power-up / reset will monitor and lock to the Master LBS Sync Pulse.

When the Slave unit is on bypass, the Slave will generate the LBS Sync Pulse.

- The Slave will slew to be locked to its own bypass source. The inverter in the LBS Slave system will follow the local bypass.
- When the Slave unit is on UPS, the Slave will stop generating the LBS Sync Pulse.

When more than one Slave unit goes to bypass:

- All systems on UPS will follow the first Slave's LBS Sync Pulse
- All other Slave systems on Bypass will follow their own local Bypass Source.

# 5.0 MAINTENANCE

## 5.1 Safety Precautions

Observe the safety precautions in the **Important Safety Instructions on page 1** of this manual.

Observe all of the warnings and cautions in this document before performing any maintenance on the UPS and associated equipment. Also observe the manufacturer's safety precautions pertaining to the battery system, along with the battery safety precautions in this section.

**WARNING**

Risk of electric shock. Can cause injury and death.

Personnel that service or maintain this equipment must be Emerson personnel or Emerson-trained personnel. Both AC and DC high voltages are present in lethal amounts within this equipment. Extreme care should be taken when working around UPS equipment.

Always identify the source of connecting wiring before disconnecting it. Mark any disconnected wires so they can be properly reconnected.

Do not substitute parts except as authorized by Emerson Network Power.

Keep the UPS cabinets free of foreign materials such as solder, wire cuttings, etc.

Call Emerson Network Power Liebert Services if you are not sure of the procedures to follow or if you are not familiar with the design or operation of the equipment.

**WARNING**

Extreme caution is required when performing maintenance.

Be constantly aware that the UPS system contains high DC as well as AC voltages. With input power off and the battery disconnected, high voltage at filter capacitors and power circuits should be discharged within 30 seconds. However, if a power circuit failure has occurred, assume that high voltage still exists after shutdown. Check with a voltmeter before making contact.

AC voltage will remain on the bypass and output contactors and the static bypass switch unless associated external circuit breakers are opened. Check for voltage with both AC and DC voltmeters before making contact.

When the UPS system is under power, both the operator and any test equipment must be isolated from direct contact with earth ground and the UPS chassis frame by using rubber mats.

Some components within the cabinets are not connected to chassis ground.

Any contact between floating circuits and the chassis is a lethal shock hazard. Use differential oscilloscopes when measuring a floating circuit. The differential input should have at least 800 vrms common mode input rating and a common mode rejection ratio of at least 80db.

Exercise caution that the test instrument exterior does not make contact either physically or electrically with earth ground.

In case of fire involving electrical equipment, use only carbon dioxide fire extinguishers or others approved for use in fighting electrical fires.

## 5.2 Routine Maintenance

Become thoroughly familiar with the equipment, but never go beyond the specific procedures in this manual while performing maintenance or correcting a malfunction. If there is any doubt as to what must be done, call Liebert Services at 1-800-LIEBERT for assistance.

The UPS is designed for unattended operation, but does require some common sense maintenance.

- Keep good records—Troubleshooting is easier there are good service records.
- Keep it clean—Keep the UPS free of dust and moisture.
- Keep it cool—Battery systems must be kept in the range of 72-77°F (22-25°C) to meet design specifications for capacity and longevity. The UPS will reliably meet all performance specifications at temperatures up to 104°F (40°C) and can be slightly derated for operation at even higher temperatures. However, performance and longevity will be optimized when the UPS is operated at the same temperature as the batteries.
- Keep connections tight—Tighten all connections at installation and at least annually thereafter.

### 5.2.1 Record Log

Set up a maintenance log to record scheduled checks and any abnormal conditions.

The log should have space for all metered data, including phase readings, alarm messages, UPS mode of operation, air filter replacement date and observations. Maintain a second log for the battery module as directed by the battery manufacturer.

Emerson recommends periodic walk-through inspections of the UPS and battery rooms to check for visible and audible indications of problems. Log the inspection, metered parameter indications and any discrepancies.

### 5.2.2 Air Filters

The air filters must be inspected and serviced regularly. The frequency of inspections will depend on environmental conditions. Under normal conditions, the air filters will require cleaning or replacement approximately every two months. Abnormal or dusty conditions will require more frequent cleaning and replacement of air filters.

Inspect installations in new buildings more often, then alter the inspection period as experience dictates.

All Liebert *e*XL models have a replaceable air filter inside the front doors. These filters can be changed while the UPS is in operation.

**NOTE**
*Service and maintenance must be performed only by properly trained and qualified personnel and in accordance with applicable regulations as well as with manufacturer's specifications.*

### 5.2.3 Limited Life Components

The Liebert *e*XL has a design life well in excess of 10 years. Well-maintained units can continue to provide economic benefits for 20 years or more. Long-life components are used in the UPS wherever practical and cost-effective. However, due to the currently available component material, manufacturing technology limitations and the general function and use of the component, a few components in the Liebert UPS will have a shorter life cycle and require replacement in less than 10 years.

The following components utilized in the UPS have a limited life cycle and are specifically exempt from warranty. To prevent a wear-out failure of one of these components affecting the critical load operations, Emerson® recommends these components be periodically inspected and replaced before the expected expiration of their life cycle. The expected life of each component listed below is simply an estimate and is not a guarantee. Individual users may have site-specific requirements, maintenance and other environmental conditions that affect the length of the component's useful life cycle.

In most cases, replacement components must exactly match the original component specifications.

These replacement components are not readily available from third-party component distributors.

For assistance with specific component specifications, replacement component selection and sourcing, call 1-800-LIEBERT. For customers using Liebert Services' preventive maintenance services, periodic inspection of these components is part of this service, as well as recommending component replacement intervals to customers to avoid unanticipated interruptions in critical load operations.

**Table 5 UPS component service life**

| Component | Expected Life | Replace in: |
|---|---|---|
| Power AC Filter Capacitors | > 7 years (~62,000 hours) | 5 to 6 years |
| Power DC Filter Capacitors | > 7 years (~62,000 hours) | 5 to 6 years |
| Low-Profile Fans | > 7 years (~62,000 hours) | 5 to 6 years |
| Air Filters | 1 to 3 years | Check four times per year |
| Battery, Lithium Logic Memory Backup | 10 years (~87,600 hours) | 8 to 9 years |
| **Battery, Storage** | | |
| Lead-acid Wet-cell (User Selection) | 15 to 20 years | 12 to 15 years |
| Valve-Regulated, Lead-Acid (VRLA) | 5 years | 2 to 3 years |
| | 10 years | 3 to 4 years |
| | 20 years | 8 to 12 years |

"Expected Life" is sometimes referred to as "Design Life."

## 5.3 Battery Maintenance

**WARNING**

Risk of electrical shock and high short circuit current. Can cause equipment damage, personal injury and death.

These maintenance procedures will expose hazardous live parts. Refer servicing to qualified personnel.

DC fuses operate at the rated battery voltage at all times. A blown DC bus fuse indicates a serious problem. Serious injury or damage to the equipment can result if the fuse is replaced without knowing why it failed. Call Liebert Services for assistance.

### 5.3.1 Battery Safety Precautions

Servicing of batteries must be performed or supervised by personnel experienced with batteries and the required precautions. Keep unauthorized personnel away from batteries.

When replacing batteries, use the same number and type of batteries.

Regular maintenance of the battery module is an absolute necessity. Periodic inspections of battery and terminal voltages, specific gravity, and connection resistance should be made. Strictly follow the procedures in the battery manufacturer's manual. (See battery manufacturer's Web site.)

Valve-regulated lead-acid batteries require periodic visual inspections and checks of battery voltage and connection resistance.

Since individual battery characteristics are not identical and may change over time, the UPS module is equipped with circuitry to equalize battery cell voltages. This circuit temporarily increases charging voltage to maintain flooded type battery cells at full capacity.

# WARNING

Risk of electrical shock. Can cause personal injury and death.

Special care must be taken when working with the batteries associated with this equipment. Be constantly aware that the battery system contains high DC as well as AC voltages. Check for voltage with AC and DC voltmeters before making contact.

Observe all DC safety precautions before working on or near the DC system.

Follow all battery safety precautions when installing, charging or servicing batteries. In addition to the hazard of electric shock, gas produced by batteries can be explosive and sulfuric acid can cause severe burns.

Lead-acid batteries contain hazardous materials. Batteries must be handled, transported, and recycled or discarded in accordance with federal, state and local regulations. Because lead is a toxic substance, lead-acid batteries should be recycled rather than discarded.

Do not dispose of battery or batteries in a fire. The battery may explode.

Do not open or mutilate the battery or batteries. Released electrolyte is harmful to the skin and eyes. It is toxic.

A battery can present a risk of electrical shock and high short circuit current. The following precautions should be observed when working on batteries:

- Remove watches, rings and other metal objects.
- Use tools with insulated handles.
- Wear rubber gloves and boots.
- Do not lay tools or metal parts on top of batteries.
- Disconnect charging source prior to connecting or disconnecting battery terminals.
- Determine if battery is inadvertently grounded. If inadvertently grounded, remove source of ground. Contact with any part of a grounded battery can result in electrical shock. The likelihood of such shock will be reduced if such grounds are removed during installation and maintenance.
- Lead-acid batteries can present a risk of fire because they generate hydrogen gas. In addition, the electrical connections must be protected against accidental short circuits which can cause sparks. The following procedures should be followed:
- Do not smoke when near batteries.
- Do not cause flame or spark in battery area.
- Discharge static electricity from body before touching batteries by first touching a grounded metal surface.
- After replacing battery jars in a battery cabinet, replace the retaining straps that hold the jars in place on the shelves. This will limit accidental movement of the jars and connectors should the cabinet ever need to be repositioned or relocated.

**NOTE**

*Do not use cleaners on the batteries. Solvents can make the battery cases brittle. Use only a dry cloth or a cloth moistened in water*

**NOTE**

*Do not use equalize charging with valve-regulated lead-acid batteries, such as those used in Liebert battery cabinets.*

*Consult the battery manufacturer's manual for specific information about equalize charging.*

The equalizing charge time is adjustable from zero to 200 hours and can be initiated automatically or manually.

### 5.3.2 Torque Requirements

All electrical connections must be tight. Refer to the torque values for the connections in the UPS below. Use these values unless the equipment is labeled otherwise.

**NOTE**
*Refer to battery manufacturer's manual for the proper torque values required for the battery. (See battery manufacturer's Web site.)*

#### Circuit Breakers With Compression Lugs for Power Wiring

- Current Rating: 400 - 1200 Amps
- Torque: 300 Lb-in (34Nm)

#### Terminal Block with Compression Lugs for Control Wiring

- AWG Wire Size or Range: #22 - #14
- Torque: 3.5 to 5.3 Lb-in (0.4 to 0.6N-m)

## 5.4 4.3 Detecting Trouble

The operator must check the instrument readings if abnormal equipment performance is suspected. Any metered value that differs appreciably from normal could mean an impending malfunction, and should be investigated.

Items to check on the various UPS display screens include:

- **Output Voltage Levels**: Output voltages of all phases should be within 1% of normal voltage. Output currents on each phase should not normally differ by more than 20%. If difference is greater, the load is unbalanced and must be corrected.
- **Battery Charge Current Levels**: If the UPS has not operated on battery power during the last 10 hours, the batteries should require little charging current. Battery mimic should indicate normal DC voltage with relatively little battery charge current.
- **Input Current**: Input current on each phase should be within 10% of the average input current. Alarm messages indicate malfunction or impending malfunction. A daily check of the Operator Control Panel will help to provide an early detection of problems. Refer to **Table 8** to interpret alarm messages.
- **Status Reports**: Alarm messages and the metered parameter indications help in tracing a problem to a particular section. These are stored in the Status Reports and can be displayed at the Operator Control Panel or at an optional terminal.

## 5.5 Reporting a Problem

If a problem occurs within the UPS, review all alarm messages along with other pertinent data. This information should be given via telephone to the Liebert Services dispatcher. This information can also be automatically sent by telephone modem. Call 1-800-LIEBERT to report a problem or to request assistance.

## 5.6 Upstream Feeder Circuit Breaker Setting Inspections

During normal UPS operations, short-term overload current demand from the bypass source may reach 10 times the UPS output current rating. This overload current demand may be caused by the magnetizing inrush current of one or more downstream transformers (i.e., power distribution units) or faults on downstream branch circuits. The instantaneous trip point(s) of the upstream bypass feeder breaker(s) must be set to support these temporary overloads. The magnitude of short-term overload bypass current demand is typically six to eight times the UPS current rating, but must be determined by analysis on a per-site basis. This analysis, generally known as an End-to-End Fault Coordination Study, must be done by a registered professional engineer experienced in this activity and familiar with local codes and related requirements.

Emerson® highly recommends periodic inspections of the bypass feeder breaker instantaneous trip settings, as well as the module input (rectifier) feeder breaker trip settings, to ensure that they are correct. For a variety of reasons, although typically during circuit breaker maintenance procedures by others, trip settings have been inadvertently left improperly set. Correct trip setting of these circuit breakers is most important to achieving high-availability from the Liebert UPS.

For further information regarding proper trip settings for the feeder breakers, call 1-800-LIEBERT.

**NOTE**

*The instantaneous trip setting of the breaker feeding the UPS bypass input should be high enough to accommodate short-duration overloads. The bypass static switch power path inside the UPS can draw up to 10 times the system's rated current for up to three cycles.*

**NOTE**

*While Emerson can provide typical guidelines, the responsibility for the proper breaker trip settings outside the Liebert-manufactured UPS equipment resides with the owner. Contact Liebert Services at 1-800-LIEBERT for further details.*

# 6.0 SPECIFICATIONS

## 6.1 Battery Operation

The separate battery manufacturer's manual, available on the manufacturer's Web site, provides the necessary information for the installation, operation and maintenance of the battery. Use the battery manual in conjunction with this manual.

The float charge voltage for a battery is equal to the number of cells in series making up the battery multiplied by the charge voltage for each cell.

Because the charging voltage level is critical to proper battery operation, refer to the battery manual, available on the manufacturer's Web site, for information about the system.

For models with nominal 240-cell battery, the DC bus nominal float voltage range is 2.15 to 2.3VPC.

Maximum equalize voltage is 2.45VPC. The number of battery cells required ranges from 228 to 246, depending on the application.

## 6.2 Other DC Sources

The separate DC source manufacturer's manual, available on the manufacturer's Web site, provides the necessary information for the installation, operation and maintenance of the DC source. Use the DC source manual in conjunction with this manual.

## 6.3 Environmental Conditions

**Table 6 Environmental specifications**

| Parameter | Specification |
|---|---|
| Enclosure | The UPS is housed in a NEMA-1 enclosure. The enclosure is designed for indoor use only and is not to be subjected to falling objects or precipitation. |
| Recommended Operating Temperature, °F (°C) | 77 (25) ambient |
| Maximum Operating Temperature, °F (°C) | 95 (35) ambient (design temperature) without derating; (see Notes **2** and **3**). |
| Minimum Operating Temperature, °F (°C) | 32 (0) |
| Storage Temperature, °F (°C) | -13 to 158 (-25 to 70) |
| Typical Battery Temperature Requirements | Average annual temperature must not exceed 80°F (27°C). Peak temperature must not exceed 109°F (43°C). See battery manufacturer's recommendations. |
| Relative Humidity | 0 to 95% without condensation |
| Operating Elevation | Sea level to 3300 ft. (1000m) without derating |
| Storage Elevation | Sea level to 50,000 ft. (15,240m) |
| Audible Noise, Typical; UPS in Normal Mode with 100% Load, free field environment method used | 84 dBA (relative to 20microPa) |

### Notes on Environmental Specifications

1. This category of electronic equipment is agency rated for use in an atmosphere free of conductive particles. Some industrial facilities may require a room air filtration system to keep the UPS free of excess moisture and contaminants.
2. The UPS is designed to operate continuously at 95°F (35°C). However, design equipment life expectancy will be extended with lower temperatures (77°F [25°C] is recommended).
3. Ambient temperature is the maximum ambient temperature during any 24-hour period. For operation at higher temperatures, consult your Emerson® sales representative or call Liebert Services at 1-800-LIEBERT.
4. Exercise care during installation to ensure unimpeded airflow through the UPS.

For operation at higher elevations, consult your Emerson sales representative or call Liebert Services at 1-800-LIEBERT.

**Table 7 Electrical and physical specifications**

| | 625-800kVA | 1000-1200kVA |
|---|---|---|
| **Input Parameters** | | |
| Input Voltage to Rectifier, VAC, 3-Phase, 3-Wire | 480V | |
| Input Voltage to Bypass, VAC, 3-Phase, 3-Wire | 480V | |
| Input Voltage Range, VAC % | +10% to -30% | |
| Input Frequency, Hz | 60 | |
| Permissible Input Frequency Range, Hz | 55 to 65 | |
| Reflected Input THDi at Nominal Voltage at Full Load, % | <5% | |
| Rectifier Power Walk-In, sec | 1 to 30 (selectable) in 1 sec. Increments | |
| **DC Parameters** | | |
| Battery Type | VRLA (Valve Regulated Lead Acid) or FLA (Flooded Lead Acid) | |
| Nominal DC Bus, VDC | 480V | |
| DC Float Voltage, VDC | 540V | |
| End-Cell Voltage, VDC | 384-502 (for VRLA / FLA) | |
| DC Ripple Voltage in Float and Const V Ch. mode, % | < 1 (RMS value) < 3.4% Vpp | |
| **Output Parameters** | | |
| Inverter Type | IGBT-based Sine-Sine PWM Controlled | |
| Output Voltage, 3-phase, 3-wire | 480V | |
| Output Voltage Regulation, % | < 1% (3-phase RMS average) | |
| Output Voltage Regulation (Unb. Load) | < 2% (3-phase RMS average) | |
| Output Frequency, Hz | 60 | |
| Output Frequency Regulation, % | ± 0.1 | |
| Output THDv at Nominal Voltage (Linear Load), % | < 3 | |
| Output THDv at nominal voltage Including a 100kVA Non Linear Load per EN 62040-3, % | 6% (max) | |
| Capacity to Handle Step Load, % | 0-100 or 100-0 | |
| Transient Recovery (Linear Loads),%, msec | Meets IEC 62040-3: 2010 Figure 2 Curve 1, Class 1 | |
| Load Power Factor Supported (Without Derating) | 0.7 Leading to 0.7 Lagging | |
| Voltage Displacement, ° el | 120° ±1° el (with unbalanced load) | |
| Overload Conditions, % FL (with DC source available) | See **Figure 16** | |
| **Physical Parameters and Standards** | | |
| Dimensions, WxDxH, in (mm) (Single Module and 1+N Systems with Static Bypass) | 123.6 x 34.4 x 77.5 (3140 x 874 x 1969) | 170.7 x 34.4 x 77.5 (4335 x 874 x 1969) |
| Weight, Single Module System with Static Bypass, lb. (kg) | 5187 (2353) | 7595 (3445) |
| Weight, 1+N System with Static Bypass, lb. (kg) | 5418 (2458) | 7877 (3573) |
| Color | Black (RAL 7021) | |
| Degree of Protection for UPS Enclosure | IP 20 (with and without front door open) | |
| Standards & Conformities | UL 1778, 4th Ed. | |
| | CSA 22.2 107.3 | |
| | FCC Part 15, Class A (with option filter installed) | |
| | IEC62040-2, Level 4, Criteria A | |
| | ANSI C62.41, Category A3 &B3 | |
| | ISTA | |
| | WEEE | |

Width dimensions are with side panels attached. Subtract 1.4" (35mm) for dimensions with both side panels removed.
The depth dimensions include the front door and rear panel.

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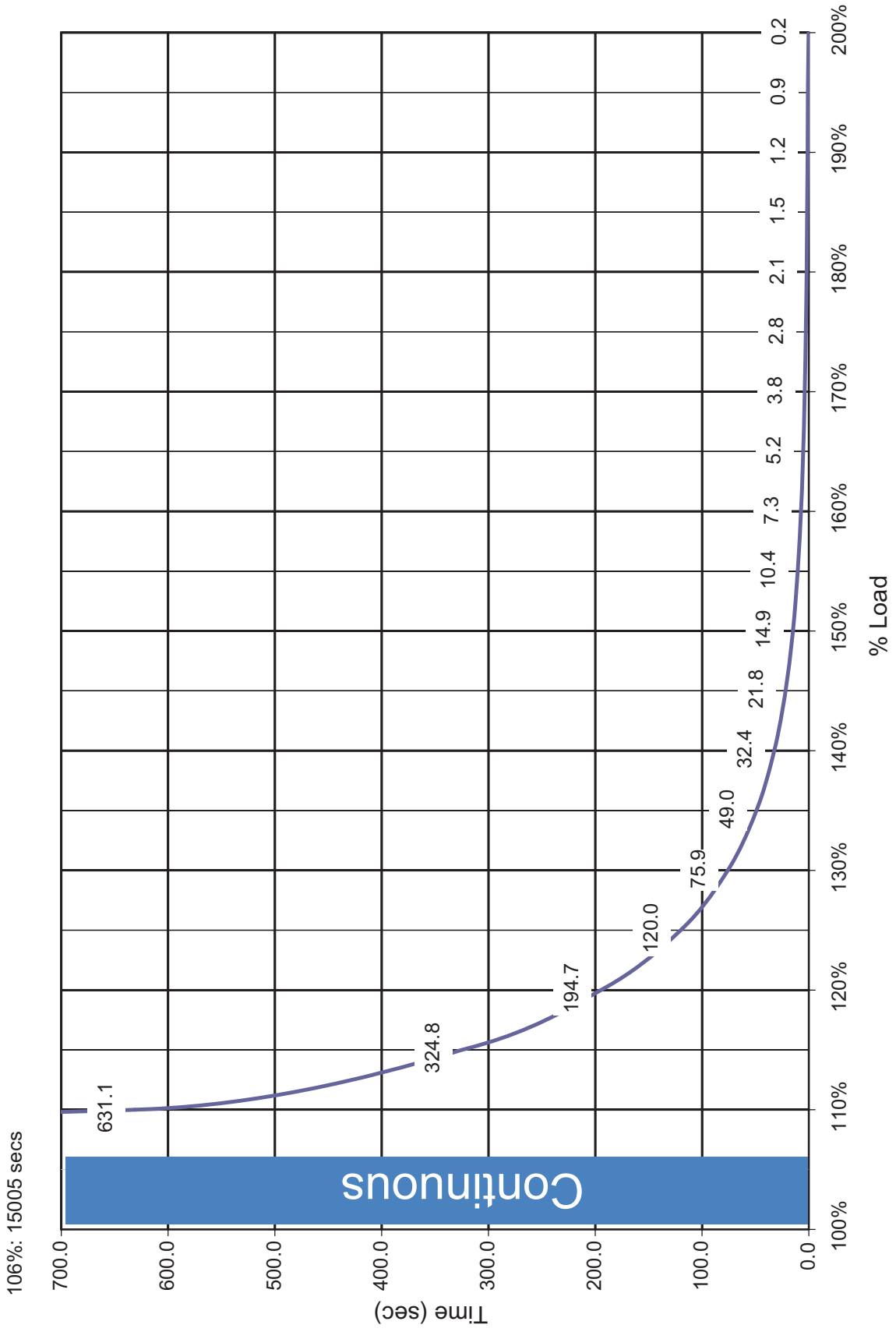
# APPENDIX A - INVERTER OVERLOAD CURVE

**Figure 16 Liebert eXL inverter overload curve**



# APPENDIX B - UPS ALARM AND STATUS MESSAGES

**Table 8 UPS Alarm and Status Messages**

| Message Text | Condition |
|---|---|
| SET - Bypass Not Available<br>CLEAR - Bypass Available | The bypass is not a qualified source due to voltage level, frequency or other condition |
| SET - Bypass Line Fail<br>CLEAR - Bypass Not Failed | All three phases of bypass voltage are less than the minimum required. |
| SET - Bypass Overvoltage<br>CLEAR - Bypass Overvoltage Clr | One or more bypass source phase voltages are greater than maximum allowed. |
| SET - Bypass Undervoltage Warn<br>CLEAR - Bypass Undervoltage Warn Clr | One or more bypass source phase voltages is less than minimum. |
| SET - Bypass Undervoltage<br>CLEAR - Bypass Undervoltage Clr | One or more bypass source phase voltages is less than minimum required. |
| SET - Bypass Freq Error<br>CLEAR - Bypass Freq OK | Bypass Line Fail is not active the bypass frequency is outside of specified range. |
| SET - Bypass Phase Rotation<br>CLEAR - Bypass Phase Rotation OK | Bypass Line Fail is not active and the phase rotation is not A-B-C. |
| SET - Bypass Sync Error<br>CLEAR - Bypass Sync Error Clr | Bypass is not synchronized. |
| SET - Manual Xfer Inhibit<br>CLEAR - Manual Xfer Clr | SMS-With Load on UPS active and bypass conditions outside of specific ranges, or BPSS Phase Open, or Bypass Static Switch Board Communication Failure or Bypass Fuse Failure are active. |
| SET - Man Rexfer Inhibit<br>CLEAR - Man Rexfer Clr | See Manual Transfer to Inverter. |
| SET - MMS Xfer Inhibit<br>CLEAR - MMS Xfer Clr | With the collective on UPS, Module Output Breaker (MOB) Open is active or bypass conditions outside of specific ranges or Bypass Static Switch Phase Open active or Bypass Fuse Failure active or Bypass Static Switch Board Communication Failure active or not enough BPSS's are available to support the measured load or any module's BPSS is connected to the collective. |
| SET - MMS Rexfer Inhibit<br>CLEAR - MMS Rexfer Clr | With the collective not on the UPS, the Module Output Breaker (MOB) Open is active or Manual Transfer to Inverter conditions are met or not enough inverters are available to support the measured load or any module's inverter is connected to the collective. |
| SET - Auto Rexfer Ready<br>CLEAR - Auto Rexfer Off | A recoverable automatic transfer to bypass has occurred. |
| SET - Auto Rexfer Failed<br>CLEAR - Auto Rexfer Failed Clr | A recoverable transfer to SBS has occurred but an automatic retransfer to inverter did not happen within a specified delay. |
| SET - Excess Auto Rexfers<br>CLEAR - Excess Auto Rexfers Clr | The number of auto retransfers in the past hour has exceeded a specified setting. |
| SET-Input Not Available<br>CLEAR-Input Available | Summary event based on the detection of at least one of the following faults:<br>Input Line Fail<br>Input Overvoltage<br>Input Undervoltage<br>Input Frequency Error<br>Input Phase Rotation Error<br>Input Sync Error<br>Input Phase Loss |
| SET -Input Line Fail<br>CLEAR - Input Not Failed | All three phases of input voltage are less than a specified voltage. |
| SET -Input Overvoltage<br>CLEAR - Input Overvoltage Clr | The input line-to-line voltages are greater than a specified percentage of nominal voltage for a specified delay. |
| SET - Input Undervoltage Warn<br>CLEAR - Input Undervoltage Warn Clr | Input line-to-line voltages are too low a percentage of nominal voltage for a specified delay. |
| SET - Input Undervoltage<br>CLEAR - Input Undervoltage Clr | With the rectifier enabled and the disconnect closed, one or more of the input line-to-ine voltages are less than minimum required. |

**Table 8 UPS Alarm and Status Messages *(continued)***

| Message Text | Condition |
|---|---|
| SET - Input Freq Error<br>CLEAR - Input Freq OK | The input frequency has exceeded a specified range. |
| SET - Input Phase Rotation<br>CLEAR - Input Phase Rotation OK | With the input source voltage above minimum threshold, the phase rotation is not<br>A-B-C. |
| SET - Input Sync Error<br>CLEAR - Input Synchronized | With the input NOT failed the rectifier cannot synchronize to input voltage. |
| SET - Input Current Limit<br>CLEAR - Input Current Normal | RMS input current has reached the input current limit setting. |
| SET - Output Fault<br>CLEAR - Output OK | Summary event based on the detection of at least one of the following faults:<br>Output Overvoltage Output Undervoltage |
| SET - Output Overvoltage<br>CLEAR - Output Overvoltage Clr | With the load on inverter, the output voltage has exceeded Overvoltage versus Time. |
| SET - Output Undervoltage<br>CLEAR - Output Undervoltage Clr | With the load on inverter and the inverter not in current limit operation, the output voltage has exceeded Undervoltage versus Time. |
| SET - Output Freq Error<br>CLEAR - Output Freq OK | With the load on inverter, the output frequency has exceeded a specified range for a specified period of time. |
| SET - Load on UPS<br>CLEAR - | Load is now being supplied power from the inverter. |
| SET - Load on Bypass<br>CLEAR - | Load is now being supplied power from the bypass source. |
| SET - Load on Maint Byp<br>CLEAR - | Maintenance Bypass Breaker (MBB) Open is not active. |
| SET - Low Power Factor<br>CLEAR - Load Power Factor OK | When any output phase is supplying at least 30% of nominal load current and the output power factor is below a specified value. |
| SET - Over Max Load Ph A<br>CLEAR - Under Max Load Ph A | The load on Phase A has exceeded a specified setting. |
| SET - System Overload<br>CLEAR - System Load Normal | One or more modules in a multi-module system is reporting an overload on at least one phase. |
| SET - Over Max Load Ph B<br>CLEAR - Under Max Load Ph B | The load on Phase B has exceeded a specified setting. |
| SET - Over Max Load Ph C<br>CLEAR - Under Max Load Ph C | The load on Phase C has exceeded a specified setting. |
| SET - BPSS Unable<br>CLEAR - BPSS Available | Summary event based on the detection of at least one of the following faults:<br>BPSS Phase Open<br>BPSS SCR Shorted |
| SET - BPSS Phase Open<br>CLEAR - | With load on bypass, one or more of the bypass static switch phases is open when static switch operation is intended. |
| SET - BPSS SCR Shorted<br>CLEAR - BPSS SCR Shorted Clr | A short has been detected across one phase of the bypass static switch. |
| SET - Pulse Paralleling<br>CLEAR - Pulse Parallel Done | With load on inverter, the load current exceeds a specified setting and the bypass static switch is available. |
| SET - Excess Paralleling<br>CLEAR - Excess Paralleling Clr | The unit has performed five or more pulse parallels within 60 seconds. |
| SET - Xfer to Byp Failed<br>CLEAR - Xfer to Byp Failed Clr | Automatic transfer to bypass was unsuccessful. |
| SET - BPSS Is On<br>CLEAR - BPSS Is Off | The controls have instructed the BPSS to turn On. DO NOT CREATE EVENT! |
| SET - BPSS Overload<br>CLEAR - BPSS Overload Clr | With the load on bypass static switch, at least one phase of the RMS current has reached the RMS Current versus Time curve. |
| SET - Bypass Overload Ph A<br>CLEAR - Bypass Ph A Overload Clr | Load is on bypass static switch, the measured Phase A output RMS current is too high. |

**Table 8 UPS Alarm and Status Messages *(continued)***

| Message Text | Condition |
|---|---|
| SET - Bypass Overload Ph B<br>CLEAR - Bypass Ph B Overload Clr | With the load on bypass static switch, the measured Phase B output RMS current has exceeded a specified percentage of the nominal per-phase RMS current rating. |
| SET - Bypass Overload Ph C<br>CLEAR - Bypass Ph C Overload Clr | With the load on bypass static switch, the measured Phase C output RMS current has exceeded a specified percentage of the nominal per-phase RMS current rating. |
| SET - Rectifier Fault<br>CLEAR - Rectifier OK | Summary event indicating at least one of the following faults:<br>DC Bus Voltage Sense Fail<br>Failure of and IGBT in Rectifier A, B or C<br>DC Overvoltage Transient<br>Rectifier Current Sensor Failure |
| SET - Vdc Sense Fail<br>CLEAR - Vdc Sense OK | With rectifier on or the DC/DC converter discharging and the DC Bus Qualified event active, the DC Bus Voltage drops a specified percentage within a specified delay. Note: The basic algorithm is to detect a rapidly falling DC Bus that goes below 50% of Nominal in a very short period of time. |
| SET - Rect A IGBT Fault<br>CLEAR - Rect A IGBT OK | The DSAT circuit related to one or more of the IGBT's in Rectifier A are activated. |
| SET - Rect B IGBT Fault<br>CLEAR - Rect B IGBT OK | The DSAT circuit related to one or more of the IGBT's in Rectifier B are activated. |
| SET - Rect C IGBT Fault<br>CLEAR - Rect C IGBT OK | The DSAT circuit related to one or more of the IGBT's in Rectifier C are activated. |
| SET - DC OV Transient<br>CLEAR - DC OV Transient Clr | The DC bus voltage has increased to a specified value. |
| SET - Rect Sense Fail<br>CLEAR - Rect Sense OK | A critical rectifier sensor has failed. |
| SET - Rect Not Sharing<br>CLEAR - Rect Sharing OK | The measured rectifier power for one or more rectifier core is greater than maximum allowed. |
| SET - Inverter Fault<br>CLEAR - Inverter OK | Summary event indicating at least one of the following faults:<br>Inverter Overvoltage<br>Inverter Undervoltage<br>Inverter A, B or C IGBT Fault<br>Inverter Backfeed Shutdown<br>Inverter Current Sensor Failure |
| SET - Inv Overvoltage<br>CLEAR - Inv Overvoltage Clr | The inverter voltage is too high. |
| SET - Inv Undervoltage<br>CLEAR - Inv Undervoltage Clr | The inverter voltage is too low and the inverter is not limiting current. |
| SET - Inv A IGBT Fault<br>CLEAR - Inv A IGBT OK | The DSAT circuit related to one or more of the IGBT's in inverter A are activated. |
| SET - Inv B IGBT Fault<br>CLEAR - Inv B IGBT OK | The DSAT circuit related to one or more of the IGBT's in inverter B are activated. |
| SET - Inv C IGBT Fault<br>CLEAR - Inv C IGBT OK | The DSAT circuit related to one or more of the IGBT's in inverter C are activated. |
| SET - Inv Backfeed Warn<br>CLEAR - Inv Backfeed Clr | The unit had detected reverse power through the inverter at a specified level for a specified time. |
| SET - Inv Backfeed Shutdn<br>CLEAR - Inv Backfeed Done | The unit had detected reverse power through the inverter at a specified level for a specified time. |
| SET - Inv Current Limit<br>CLEAR - Inv Current OK | With Pulse Parallel not active, the instantaneous inverter current of any one phase has exceeded a specified setting. |
| SET - Inv Overload Shutdn<br>CLEAR - Inv Overload Done | At least one phase RMS Current has reached the RMS Current versus Time curve. |
| SET - Inv Overload Ph A<br>CLEAR - Inv Overload Ph A Clr | Phase A RMS Current has reached the kW or RMS Current versus Time curve. |

**Table 8 UPS Alarm and Status Messages *(continued)***

| Message Text | Condition |
|---|---|
| SET - Inv Overload Ph B<br>CLEAR - Inv Overload Ph B Clr | Phase B RMS Current has reached the kW or RMS Current versus Time curve. |
| SET - Inv Overload Ph C<br>CLEAR - Inv Overload Ph C Clr | Phase C RMS Current has reached the kW or RMS Current versus Time curve. |
| SET - Inv Sense Fail<br>CLEAR - Inv Sense OK | A critical inverter sensor has failed. |
| SET - Inv Not Sharing<br>CLEAR - Inv Sharing OK | The measured inverter power for one or more inverter core is greater than a specified percent of the average power for a specified period of time. |
| SET - DC/DC IGBT Fault<br>CLEAR - DC/DC IGBT Fault Clr | The DSAT circuit related to one or more of the IGBT's in the DC/DC Converter is active |
| SET - DC/DC Not Sharing<br>CLEAR - DC/DC Sharing OK | Discharge Only: The measured DC/DC converter current for one or more cores is greater than a specified value for a specified period of time. |
| SET - DC Bal IGBT Fault<br>CLEAR - DC Bal IGBT Fault Clr | The DSAT circuit related to one or more of the IGBT's in the DC Balancer is active. |
| SET - System Low Battery<br>CLEAR - System Battery OK | When the number of modules with a Battery Low Warning event active exceeds the number of redundant modules on line. |
| SET - Batt Discharging<br>CLEAR - Batt Discharge Ends | With at least one battery circuit breaker closed and common MBD is closed (if applicable), the DC bus has reached a specified setting or the discharge current has reached a specified setting. |
| SET - Low Battery Warning<br>CLEAR - Low Battery Clr | With the battery breaker closed, the calculated Battery Time Remaining has reached a specified setting. |
| SET - Low Batt Shutdown<br>CLEAR - Low Batt Shutdown Clr | With the battery breaker closed, the battery voltage has dropped below the calculated End-Of-Discharge (EOD) limit. |
| SET - Low Batt Capacity<br>CLEAR - Low Batt Capacity Clr | With the load on UPS inverter and common MBD is closed (if applicable) and at least one battery breaker is closed, at least one other battery breaker is open. |
| SET - System On Battery<br>CLEAR - System Not On Battery | When the number of modules on battery exceeds the number of redundant modules on line. |
| SET - Batt Sensor Fail<br>CLEAR - Batt Sensor OK | Summary event indicating at least one active Battery Temperature Sensor Failure for Cabinet #1-#8. |
| SET - Batt Sense Fail Service<br>CLEAR - Batt Sense Service OK | With the corresponding Battery Temperature setting enabled, the battery temperature sensor reports a temperature outside of the range of expected operation. |
| SET - Batt Temp Imbalance<br>CLEAR - Batt Temp Balance OK | For strings with the battery breaker closed, two battery temperatures have a difference greater than a specified value for a specified delay and associated battery temperature sensor fail event not active. |
| SET - Batt Ovtemp Warning<br>CLEAR - Batt Ovtemp Warn Clr | The battery temperature of any string with the battery breaker closed exceeds tolerance. |
| SET - Batt Ovtemp Stop Chrg<br>CLEAR - Batt Ovtemp Stop Chrg Clr | The battery temperature of any string with the battery breaker closed exceeds. |
| SET - Batt Ovtemp Limit<br>CLEAR - Batt Ovtemp Limit Clr | Summary event based on the detection of an overtemperature fault in one or more of up to eight battery cabinets. |
| SET - Batt Ovtemp Limit Service<br>CLEAR - Batt Ovtemp Limit Ser Clr | With the a given battery breaker, the given battery temperature has reached a specified setting. |
| SET - Batt Test Failed<br>CLEAR - | The battery test has failed. |
| SET - Batt Test Inhibit<br>CLEAR - | Battery testing has been inhibited (See Parametric Data or Testing Start Conditions for more detail). |
| SET - Batt Test Passed<br>CLEAR - | The battery has passed a battery test. |
| SET - Batt Self Test<br>CLEAR - Batt Test Done | See operation for Battery Testing. |
| SET - Batt Test Stopped<br>CLEAR - | The Battery Test-Manual Stop command is present. |

**Table 8 UPS Alarm and Status Messages *(continued)***

| Message Text | Condition |
|---|---|
| SET - Batt Log Cleared<br>CLEAR - | The system has received a command to clear the battery log data. |
| SET - DC Bus Not Qualified<br>CLEAR - DC Bus Qualified | DC Bus is outside specified limits. |
| SET - Batt Cycle Log Full<br>CLEAR - Batt Cycle Log OK | The system has detected that the number of records in the battery log has exceeded a specified number. |
| SET - Batt Equalizing<br>CLEAR - Batt Equalize Done | See operation for Equalize Charging. |
| SET - Batt Commissioning<br>CLEAR - Batt Commiss Done | See operation for Commissioning. |
| SET - Batt Mon 1 Maint<br>CLEAR - Batt Mon 1 Maint Clr | The Battery Interface Board with Battery Monitor 1 enabled has the Maintenance Alarm become active. |
| SET - Batt Mon 1 Critical<br>CLEAR - Batt Mon 1 Crit Clr | The Battery Interface Board with Battery Monitor 1 enabled has the Critical Alarm become active. |
| SET - Internal Comm Error<br>CLEAR - Internal Comm Error Clr | Summary event indicating at least one of the following faults:<br>UPSC (UPS Control Board) Communication Failure<br>CBIB (Circuit Breaker Interface Board) Communication Failure<br>HMI Communication Failure<br>Fan Interface Board Communication Failure<br>Programmable Relay Board Communication Failure<br>Input Contact Interface Communication Failure<br>MBD/BCB Communication Failure<br>MBD / BIS Communication Failure<br>Temperature Interface Board Communication Failure<br>Remote Alarm Status Panel Interface Communication Failure<br>UPS Module Communication Failure |
| SET - Controls Comm Fail<br>CLEAR - Controls Comm Fail Clr | With Main Controller Fault not active, the UPSC is no longer communicating with the system. |
| SET - BPSS Comm Fail<br>CLEAR - BPSS Comm Fail Clr | The “BPSS Is Ok” signal between the UPSC and the BPSS control board has failed to toggle. |
| SET - HMI Comm Fail<br>CLEAR - HMI Comm Fail Clr | HMI is no longer communicating with the system. |
| SET - FIB Comm Fail<br>CLEAR - FIB Comm Fail Clr | FIB is no longer communicating with the system. |
| SET - PRB Comm Fail<br>CLEAR - PRB Comm Fail Clr | With Programmable Relay Board set as “Enabled” communication by the board is stopped. |
| SET - ICI Comm Fail<br>CLEAR - ICI Comm Fail Clr | With Input Contact Interface set as “Enabled” communication by the board is stopped. |
| SET - MBD/BCB Comm Fail<br>CLEAR - MBD/BCB Comm Fail Clr | With Battery Interface Board MBD set as “Enabled” communication by the BIB addressed as MBD/BCB is stopped. |
| SET - MBD/ BIS Comm Fail<br>CLEAR - MBD/ BIS Comm Fail Clr | With Battery Interface Board String 1 set as “Enabled,” communication by the BIB addressed as MBD/BIS is stopped. |
| SET - TIB Comm Fail<br>CLEAR - TIB Comm Fail Clr | TIB is no longer communicating with the system. |
| SET - Parallel Comm Warn<br>CLEAR - Parallel Comm Warn Clr | One of the paralleling control communication busses is no longer communicating within the system. |
| SET - System Comm Fail<br>CLEAR - System Comm Fail Clr | Summary event based on the detection of at least one of the following faults:<br>UPS Module #1 Communication Failure<br>UPS Module #2 Communication Failure<br>UPS Module #3 Communication Failure<br>UPS Module #4 Communication Failure<br>UPS Module #5 Communication Failure<br>UPS Module #6 Communication Failure<br>SCC Communication Failure |

**Table 8 UPS Alarm and Status Messages *(continued)***

| Message Text | Condition |
|---|---|
| SET - SCC Comm Fail<br>CLEAR - SCC Comm Fail Clr | SCC is no longer communicating with the system. |
| SET - RSP Comm Fail<br>CLEAR - RSP Comm Fail Clr | RSP is no longer communicating with the system. |
| SET - UPS Comm Fail<br>CLEAR - UPS Comm Fail Clr | UPS module is no longer communicating with the system. |
| SET - Password Changed<br>CLEAR - | The user has changed the password. |
| SET - Manual Xfer to Byp<br>CLEAR - | Transfer to Bypass command is active. |
| SET - Manual Xfer to Inv<br>CLEAR - | Transfer to Inverter command is active. |
| SET - System Xfer to Byp<br>CLEAR - | MMS Transfer to Bypass command is active. |
| SET - System Xfer to Inv<br>CLEAR - | MMS Transfer to Inverter command is active. |
| SET - EPO Shutdown<br>CLEAR - EPO Shutdown Clr | The EPO signal is active. |
| SET - EMO Shutdown<br>CLEAR - EMO Shutdown Clr | The EMO signal is active. |
| SET - User Event Reset<br>CLEAR - | From the HMI Event Reset is active |
| SET - User Shutdown<br>CLEAR - | Shutdown-UPS Command or Shutdown-System Command is present. |
| SET - Config Modified<br>CLEAR - | One or more settings on the configuration screen have been modified. |
| SET - Controls Reset Req<br>CLEAR - | One or more of the following settings has changed:<br>Nominal Input Voltage<br>Nominal Bypass Voltage<br>Nominal Output Voltage<br>Nominal Source Frequency<br>Nominal Output Frequency<br>Output kVA<br>Output kW<br>Configuration Type<br>Rectifier Type<br>Nominal Cell Count-Lead Acid<br>System Amp Rating<br>Unit Model Number<br>Bypass Breaker<br>Input Breaker Operation<br>Input Breaker Type<br>Output Breaker Operation (SMS, 1+N)<br>Output Breaker Type<br>Battery Configuration<br>Battery Type<br>Common Battery Disconnect<br>Maintenance Bypass Model Number<br>System Paralleling Cabinet Model Number |
| SET - User kWh Reset<br>CLEAR - | kWh Reset command is active. |
| SET - User Peak kW Reset<br>CLEAR - | Peak kW Demand Reset command is active. |
| SET - Service Code Active<br>CLEAR - | Open loop service code running. |

**Table 8 UPS Alarm and Status Messages *(continued)***

| Message Text | Condition |
|---|---|
| SET - Service Reminder<br>CLEAR - | See Service Reminders Operations. |
| SET - Multi Fan Fail<br>CLEAR - Multi Fan Fail Clr | Summary event indicating at least two fans (out of up to 32 fans, depending on UPS model) have failed. |
| SET - Fan Fail<br>CLEAR - Fan Fail Clr | Summary event indicating that one fan (out of up to 32 fans, depending on UPS model) have failed. |
| SET - Fan Fail Service<br>CLEAR - Fan Fail Service Clr | With the critical bus energized, a given fan is no longer operational. |
| SET - Fuse Fail<br>CLEAR - Fuse Fail Clr | Summary event based on the detection of at least one of the following faults:<br>Input Fuse Failure<br>Rectifier Fuse Failure<br>Inverter Fuse Failure<br>Bypass Static Switch Fuse Failure<br>Battery Static Switch Fuse Failure<br>Core-2-Core Fuse Failure |
| SET - Input Fuse Fail<br>CLEAR - | One or more input fuses are open on a unit configured and operating with an input fuses. |
| SET - Rectifier Fuse Fail<br>CLEAR - | A rectifier fuse indicates that it is failed |
| SET - Inv Fuse Fail<br>CLEAR - | An inverter fuse indicates that it is failed. |
| SET - Bypass Fuse Fail<br>CLEAR - | Any bypass fuse indicates that it is failed. |
| SET - Batt Fuse Fail<br>CLEAR - Batt Fuse Fail Clr | One or more of the battery fuses indicates it is open. |
| SET - Core Fuse Fail<br>CLEAR - | One or more of the core-to-core fuses indicate open |
| SET - Power Supply Fail<br>CLEAR - Power Supply Fail Clr | Summary event indicating at least one of the following faults:<br>Input Power Supply Fail<br>Bypass Power Supply Fail<br>DC Power Supply Fail<br>Output Power Supply Fail |
| SET - Power Supply Service Fail<br>CLEAR - Power Supply Service Fail Clr | Power Supply Board reports a failure of one or more power supplies. |
| SET - Breaker Open Fail<br>CLEAR - Breaker Open Fail Clr | Summary event based on the detection of at least one of the following faults:<br>Backfeed Breaker Open Fail<br>System Output Breaker (UOB) Open Fail<br>Rectifier Input Breaker (CB1) Open Fail<br>Bypass Breaker (SBB) Open Fail<br>Module Battery Disconnect Open Fail<br>Battery CB (#1-5) Open Fail<br>Inverter Output Breaker (CB2) Open Fail |
| SET - Breaker Close Fail<br>CLEAR - Breaker Close Fail Clr | Summary event based on the detection of at least one of the following faults:<br>System Output Breaker (UOB) Close Fail<br>Rectifier Input Breaker (CB1) Close Fail<br>Bypass Breaker (SBB) Close Fail<br>Module Battery Disconnect Close Fail<br>Battery CB (#1-5) Close Fail<br>Inverter Output Breaker (CB2) Close Fail |
| SET - BFB Trip Signaled<br>CLEAR - | A command to trip the backfeed breaker is active. |
| SET - BFB Open Fail<br>CLEAR - BFB Open Fail Clr | The backfeed breaker open signal did not transition to a TRUE state within a specified delay. |
| SET - BFB Open<br>CLEAR - BFB Closed | BFB is open. |

**Table 8 UPS Alarm and Status Messages *(continued)***

| Message Text | Condition |
|---|---|
| SET - UOB Open Fail<br>CLEAR - UOB Open Fail Clr | UOB open signal did not transition to a TRUE state within a specified delay. |
| SET - UOB Close Fail<br>CLEAR - UOB Close Fail Clr | UOB close signal did not transition to a TRUE state within a specified delay. |
| SET - UOB Open<br>CLEAR - UOB Closed | UOB indicates that it is open. |
| SET - CB1/RIB Open Fail<br>CLEAR - CB1/RIB Open Fail Clr | Rectifier Input Breaker (CB1/RIB) open signal did not transition to a TRUE state within a specified delay. |
| SET - CB1/RIB Close Fail<br>CLEAR - CB1/RIB Close Fail Clr | Rectifier Input Breaker (CB1/RIB) closed signal did not transition to a TRUE state within a specified delay. |
| SET - CB1/RIB Open<br>CLEAR - CB1/RIB Closed | CB1/RIB indicates that it is open. |
| SET - CB2/IOB Open Fail<br>CLEAR - CB2/IOB Open Fail Clr | Inverter Output Breaker (CB2/IOB) open signal did not transition to a TRUE state within a specified delay. |
| SET - CB2/IOB Close Fail<br>CLEAR - CB2/IOB Close Fail Clr | Inverter output breaker close signal did not transition to a TRUE state within a specified delay. |
| SET - CB2/IOB Open<br>CLEAR - CB2/IOB Closed | CB2/IOB indicates that it is open. |
| SET - SBB Open Fail<br>CLEAR - SBB Open Fail Clr | Bypass Breaker (SBB) open signal did not transition to a TRUE state within a specified delay. |
| SET - SBB Close Fail<br>CLEAR - SBB Close Fail Clr | Bypass Breaker (SBB) closed signal did not transition to a TRUE state within a specified delay. |
| SET - SBB Open<br>CLEAR - SBB Closed | Bypass circuit breaker indicates that it is open. |
| SET - MBD/BCB Open Fail<br>CLEAR - MBD/BCB Open Fail Clr | Module Battery Disconnect open signal did not transition to a TRUE state within a specified delay. |
| SET - MBD/BCB Close Fail<br>CLEAR - MBD/BCB Close Fail Clr | Module Battery Disconnect closed signal did not transition to a TRUE state within a specified delay. |
| SET - MBD/BCB Open<br>CLEAR - MBD/BCB Closed | MBD is open. |
| SET - Batt CB Open Fail<br>CLEAR - Batt CB Open Fail Clr | One or more Battery CB open signal did not transition to a TRUE state within a specified delay. |
| SET - Batt CB Close Fail<br>CLEAR - Batt CB Close Fail Clr | One or more Battery CB closed signal did not transition to a TRUE state within a specified delay. |
| SET - Batt CB(#1-8) Open<br>CLEAR - Batt CB1 Closed | Battery breaker (#1-8) 1 indicates that it is open. |
| SET - RFB Open<br>CLEAR - RFB Closed | RFB indicates that it is open. |
| SET - BIB Open<br>CLEAR - BIB Closed | BIB indicates that it is open. |
| SET - MBB Open<br>CLEAR - MBB Closed | MBB indicates that it is open. |
| SET - MIB Open<br>CLEAR - MIB Closed | MIB indicates that it is open. |
| SET - MOB Open<br>CLEAR - MOB Closed | MOB indicates that it is open. |
| SET - LBB Open<br>CLEAR - LBB Closed | LBB indicates that it is open. |
| SET - Summary<br>CLEAR - Summary Clr | At least one User Alarm or Fault has become active. DO NOT CREATE EVENT! |
| Custom: Input Contact 1.1<br>Pre - Assigned: Reduced Rect Limit | Input contact channel signal is active. |

**Table 8 UPS Alarm and Status Messages *(continued)***

| Message Text | Condition |
|---|---|
| Custom: Input Contact 1.2<br>Pre - Assigned: Reduced Batt Limit | Input contact channel signal is active. |
| Custom: Input Contact 1.3<br>Pre - Assigned: Stop Battery Charge | Input contact channel signal is active. |
| Custom: Input Contact 1.4<br>Pre - Assigned: Inhibit Auto Restart | Input contact channel signal is active. |
| Custom: Input Contact 1.5<br>Pre - Assigned: EcoMode Suspended | Input contact channel signal is active. |
| Custom: Input Contact 1.6<br>Pre - Assigned: Inhibit BPSS | Input contact channel signal is active. |
| Custom: Input Contact 1.7<br>Pre - Assigned: Manual Xfer to UPS | Input contact channel signal is active. |
| Custom: Input Contact 1.8<br>Pre - Assigned: Manual Xfer to BPSS | Input contact channel signal is active. |
| Custom: Input Contact 2.1<br>Pre - Assigned: Inhibit Intelligent Paralleling | Input contact channel signal is active. |
| Custom: Input Contact 2.2<br>Pre - Assigned: None | Input contact channel signal is active. |
| Custom: Input Contact 2.3<br>Pre - Assigned: None | Input contact channel signal is active. |
| Custom: Input Contact 2.4<br>Pre - Assigned: None | Input contact channel signal is active. |
| Custom: Input Contact 2.5<br>Pre - Assigned: None | Input contact channel signal is active. |
| Custom: Input Contact 2.6<br>Pre - Assigned: None | Input contact channel signal is active. |
| Custom: Input Contact 2.7<br>Pre - Assigned: None | Input contact channel signal is active. |
| Custom: Input Contact 2.8<br>Pre - Assigned: None | Input contact channel signal is active. |
| SET - History Log Full<br>CLEAR - History Log Available | All history logs are full. |
| SET - History Log 1 Clear<br>CLEAR - | History Log 1 Clear commands is active. |
| SET - History Log 2 Clear<br>CLEAR - | History Log 2 Clear commands is active. |
| SET - Event Log Clear<br>CLEAR - | Event log has been cleared. |
| SET - Equip Ovtemp<br>CLEAR - Equip Ovtemp Clr | Summary event indicating at least one of the following faults:<br>Rectifier Heat Sink Overtemperature Warning<br>Inverter Heat Sink Overtemperature Warning<br>Bypass Static Switch Heat Sink Overtemperature Warning DC/DC Heatsink Overtemperature Warning<br>DC Balancer Heat Sink Overtemperature Warning |
| SET - Equip Ovtemp Limit<br>CLEAR - Equip Ovtemp Limit Clr | Summary event based on the detection of at least one of the following faults:<br>Rectifier Heat Sink Overtemperature Limit<br>Inverter Heat Sink Overtemperature Limit<br>Bypass Static Switch Heat Sink Overtemperature Limit<br>DC/DC Heat Sink Overtemperature Limit<br>DC Balancer Heat Sink Overtemperature Limit |
| SET - Inlet Ovtemp<br>CLEAR - Inlet Ovtemp Clr | The inlet air temperature exceeds a specified setting. |

**Table 8 UPS Alarm and Status Messages *(continued)***

| Message Text | Condition |
|---|---|
| SET - Outlet Ovtemp Limit<br>CLEAR - Outlet Ovtemp Limit Clr | With the critical bus energized (power applied to the cooling fans), the difference between the<br>Outlet Air Temperature 1 and the Inlet Air Temperature or<br>Outlet Air Temperature 2 and the Inlet Air Temperature or<br>Outlet Air Temperature 3 and the Inlet Air Temperature or<br>Outlet Air Temperature 4 and the Inlet Air Temperature<br>exceeds a specified value. |
| SET - Rect Ovtemp Warn<br>CLEAR - Rect Ovtemp Warn Clr | Rectifier semiconductor heat sink temperature exceeds a specified value. |
| SET - Rect Ovtemp Limit<br>CLEAR - Rect Ovtemp Limit Clr | Rectifier semiconductor heat sink temperature exceeds a specified value. |
| SET - Inv Ovtemp Warn<br>CLEAR - Inv Ovtemp Warn Clr | Inverter semiconductor heat sink temperature exceeds a specified value. |
| SET - Inv Ovtemp Limit<br>CLEAR - Inv Ovtemp Limit Clr | Inverter semiconductor heat sink temperature exceeds a specified setting. |
| SET - BPSS Ovtemp Warn<br>CLEAR - BPSS Ovtemp Warn Clr | Bypass static switch semiconductor heat sink temperature exceeds a specified value. |
| SET - BPSS Ovtemp Limit<br>CLEAR - BPSS Ovtemp Limit Clr | Bypass static switch semiconductor heat sink temperature exceeds a specified value. |
| SET - DC/DC Ovtemp Warn<br>CLEAR - DC/DC Ovtemp Warn Clr | DC/DC heat sink temperature exceeds a specified value. |
| SET - DC/DC Ovtemp Limit<br>CLEAR - DC/DC Ovtemp Limit Clr | DC/DC heat sink temperature exceeds a specified value. |
| SET - DC Bal Ovtemp Warn<br>CLEAR - DC Bal Ovtemp Warn Clr | DC Balancer heat sink temperature exceeds a specified value. |
| SET - DC Bal Ovtemp Limit<br>CLEAR - DC Bal Ovtemp Limit Clr | DC Balancer heat sink temperature exceeds a specified value. |
| SET - Temp Sense Fail<br>CLEAR - Temp Sense OK | One or more temperature sensors report a temperature outside of the range of expected operation. |
| SET - Regen Active<br>CLEAR - Regen Completed | Regeneration Testing Start command is present. |
| SET - Regen Terminated<br>CLEAR - | Regeneration is active and Regeneration Testing Stop command is present or Regeneration Operating Duration time is completed. |
| SET - Regen Failure<br>CLEAR - | Regeneration Active is active and Bypass not Qualified or DC Bus Qualified is not active or Load On UPS is not active or Manual Transfer Inhibit is active or Inverter Overload Exceeded is active or any attempt to automatically transfer to bypass. |
| SET - ECO Mode Active<br>CLEAR - ECO Mode Complete | Conditions to Activate or Automatic Reactivation have been satisfied. |
| SET - ECO Mode Suspended<br>CLEAR - ECO Mode Allowed | When an ECO Mode Session is suspended. |
| SET - Excess ECO Suspends<br>CLEAR - Excess ECO Recovered | When an ECO Mode Session is active, the number of automatic suspensions has exceeded the ECO Mode-Maximum Auto Suspensions setting. |
| SET - Main Control Fault<br>CLEAR - Main Control OK | The redundant system has detected that the main UPS control has failed via a “watchdog” timeout mechanism. |
| SET - Controller Error<br>CLEAR - Controller OK | Summary event based on the detection of at least one of the following faults:<br>MCU Communications Failure<br>Control DSP Failure |
| SET - MCU Comm Failure<br>CLEAR - MCU Comm OK | The system has detected a loss of communication with one or more MCU cores. |
| SET - Control DSP Failure<br>CLEAR - Control DSP OK | One or both of the control DSP’s have failed. |
| SET - On Gen Active<br>CLEAR - On Gen Inactive | Generator Installed setting is “Installed” and the generator input channel is active. |

**Table 8 UPS Alarm and Status Messages *(continued)***

| Message Text | Condition |
|---|---|
| SET - LBS Active Slave<br>CLEAR - LBS Slave Inactive | With the Load Bus Sync Operation setting enabled, the functional LBS Slave is following the LBS sync pulse. |
| SET - LBS Active Master<br>CLEAR - LBS Master Inactive | With the Load Bus Sync Operation setting enabled, the functional LBS Master is generating the LBS sync pulse. |
| SET - LBS Inhibited<br>CLEAR - LBS Allowed | With the Load Bus Sync Operation setting enabled and LBS Type setting is Analog, LBS Voltage RMS is not qualified or LBS Voltage frequency is out of tolerance or LBS Voltage has incorrect phase rotation. With the Load Bus Sync Operation setting enabled and LBS Type setting Digital and Load Bus Sync-Master Select setting Master, a valid LBS sync signal is detected. With the Load Bus Sync Operation setting enabled and LBS Type setting Digital and Load Bus Sync-Master Select setting Slave, LBS Sync Signal is outside Bypass Tracking Window setting. |
| SET - Restart in Process<br>CLEAR - Restart Complete | With Auto Restart setting set to Enable and Battery Low Shutdown active and Auto Restart Failed is not active and Auto Restart Inhibited is not active, the conditions for automatic restart are active. See Auto Restart Sequences |
| SET - Auto Restart Fail<br>CLEAR - | With Auto Restart Initiated active, the conditions for automatic restart have failed. See Conditions to Terminate Auto Restart |
| SET - Restart Inhibited<br>CLEAR - Restart Allowed | With Auto Restart setting set to Enable and Battery Low Shutdown active and Auto Restart Failed is not active, Input Contact Interface 1 (Channel #4) is active or Input Contact Interface 1 (Channel #5) is active or Input Contact Interface 1 (Channel #6) is active |
| SET - Loss of Redundancy<br>CLEAR - Redundancy Restored | When the Redundant Module setting is YES, the number of modules of redundancy is less than a specified value. |
| SET - Module Alarm Active<br>CLEAR - Module Alarm Clr | When any module reports an active alarm or fault to the SCC. |
| SET - Share Calib Active<br>CLEAR - Share Calib Complete | When a module has begun calibration of sharing integral or a module has reloaded the stored calibrated sharing integral. |
| SET - Module In Standby<br>CLEAR - Module Standby Exit | The conditions for Module Standby operations are active. |
| SET - Cont Tie Active<br>CLEAR - Cont Tie Inactive | Power Tie Cabinet indicates that continuous power tie is active. |
| SET - DC Charger OV<br>CLEAR - DC Charger OV Clr | The voltage output of the DC Charger has exceeded a specified threshold. |
| SET - IGBT Desat Fault<br>CLEAR - IGBT Desat Fault Clr | This is a fault that is detected by either the Rectifier MCU or the Inverter MCU or both. A signal is generated by the corresponding IGBT driver board for the various power electronic circuits, (1) Rectifier, (2) Inverter, (3) DC/DC Converter and (4) DC Balancer. The DC/DC Converter and the DC Balancer share the same signal so if either power electronic circuit has an IGBT Desat fault, both triggers will occur, 2 events will be logged and both circuits will be disabled. Each MCU will generate this same event but parametric data will be used to distinguish which power electronic circuit created the fault.<br>----<br>A desat fault signal from an IGBT driver board is active. |

**Table 8 UPS Alarm and Status Messages *(continued)***

| Message Text | Condition |
|---|---|
| SET - Emergency Transfer<br>CLEAR - Emergency Transfer Clr | The system has detected a condition that requires an immediate transfer to bypass. Parametric data is used to distinguish which conditions triggered the transfer. |
| SET - Precharge Fail<br>CLEAR - Precharge Fail Clr | **Startup**: After a specified delay from the time the precharge contactor close command is sent, the DC Bus failed to be greater than or equal to a specified value.<br>**Shutdown**: Following a full system shutdown, CB1 Open, Inverter Off, Bypass Off, the DC BUS is above a specified voltage for a specified period of time. |
| SET - CBIB Comm Fail<br>CLEAR - CBIB Comm Fail Clr | The system has detected that one or more CBIB are communicating. |
| SET - Critical Bus Off<br>CLEAR - | Load is not being supported by UPS, Bypass or Maint Bypass |
| SET - SD Card Removed<br>CLEAR - | SD card has been removed. |
| SET - Text - Auto Calib Active<br>CLEAR - Auto Calib Done | Auto calibration sequence has begun. |
| SET - Text - Auto Calib Failed<br>CLEAR - Auto Calib Failed Clr | UPSC has detected an error during ADC channel calibration. |
| SET - Input Phase Loss<br>CLEAR - Input Phase Loss Clr | Any one input phase current is less than a specified percentage of the 3-phase average input current for a specified period of time. |
| SET - Manual Remove Module<br>CLEAR - | Remove module (Xfer to Bypass) command is active. |
| SET - Manual Add Module<br>CLEAR - | Add module (Xfer to UPS) command is active. |

# NOTES

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